Ministry of Agriculture of the Russian Federation
Federal State Budgetary Educational Institution
of Higher Education
«St. Petersburg State University of Veterinary Medicine»

APPROVED BY
Vice-Rector for Educational
Work and Youth Policy
Sukhinin A.A.
May 6, 2024

Department of Genetic and Reproductive Biotechnologies

EDUCATIONAL WORK PROGRAM

for the discipline

«VETERINARY GENETICS»

The level of higher education
SPECIALIST COURSE

Specialty 36.05.01 Veterinary Medicine
Full-time education
Education starts in 2024

Reviewed and adopted
at the meeting of the department
on May 2, 2024.
Protocol No. 9

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Professor, Doctor of Veterinary Sciences,
Corresponding Member of the Russian Academy of Sciences
_____ Plemyashov K.V.

Saint Petersburg
2024

1. AIMS AND OBJECTIVES OF THE DISCIPLINE

The purpose of the discipline is to study fundamental issues of general and veterinary genetics, to obtain scientific, theoretical and practical knowledge on genetic diagnosis and prevention of hereditary anomalies and diseases in animals. Familiarization with modern ideas about gene structure, regulation of gene activity, genome editing methods, model objects of genetics. Study of the basics of genomic selection, genetic markers of productivity and resistance of productive animals for use in the practice of veterinary selection.

To achieve this goal, it is necessary to solve the following objectives:

1) the general educational task is to study the genome of various types of farm animals, hereditary anomalies, mutational variability and diseases with hereditary predisposition, mastering modern methods for diagnosing latent carriers of genetic defects;

2) the applied task covers the influence of various factors on heredity and variability, animal resistance to diseases and climate change, the search for markers of resistance and susceptibility, the creation of disease-resistant lines, types, and breeds of animals with a low genetic load.

2. THE LIST OF THE PLANNED RESULTS OF THE DISCIPLINE (MODULE), CORRELATED WITH THE PLANNED RESULTS OF THE REALISED EDUCATIONAL PROGRAM

As a result of mastering the discipline, the student prepares for the following types of activities, in accordance with the educational standard of the FSE on 36.05.01 «Veterinary Medicine».

The field of professional activity:

13 Agriculture.

The student's competencies formed (acquired) as a result of mastering the discipline

The education of the discipline should form the following competencies:

a) General professional competencies (GPC)

GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body.

GPC-2 ID-1 To know: ecology factors of the environment, its classification and the nature of relationships with living organisms: basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body.

GPC-2 ID-3 To possess skills of: the knowledge of the origin of living organisms, the levels of organization of living matter, favorable and unfavorable factors affecting the body; the basis for studying environmental knowledge of the environment, the laws of the development of nature and society; skills of observation, comparative analysis, historical and experimental modeling of the impact of anthropogenic and economic factors on living objects, with the use of digital technologies as well.

3. THE PLACE OF DISCIPLINE IN THE STRUCTURE OF THE MPEP

The discipline B1.O.18 «Veterinary genetics» is discipline of the Block 1 basic part of Federal State Educational Standard Of Higher Education in specialty 36.05.01 «Veterinary medicine» (level of higher education - specialist).

The course is mastered during first semester for full-time mode of study.

When studying «Veterinary genetics» course, the students use knowledge and skills acquired in such disciplines as biology, histology and embryology, biochemistry, physiology.

The discipline «Veterinary genetics» is the basis for such disciplines as:

1. Physiology and ethology of animals.
2. Embryology.
3. Clinical diagnosis.
4. Internal non-communicable diseases.
5. Pathological anatomy and forensic veterinary examination.
6. Veterinary and sanitary examination.
7. Obstetrics and gynecology.
8. Immunology and virology.
9. Diseases of laboratory, small and exotic animals.
10. Diseases of productive animals.

4. THE SCOPE OF DISCIPLINE AND TYPES OF ACADEMIC WORK

4.1. The scope of the discipline for full-time education

Type of educational work	Hours	Semesters
		1
Classroom classes (total)	**68**	**68**
Including:	-	-
Lectures, including interactive forms	34	34
Practical (PP), including interactive forms, among which are:	34	34
- practical training (PT)	6	6
Self-study	**13**	**13**
Essay	+	+
Type of intermediate and final certification (exam)	**Exam**	**Exam**
Control	**27**	**27**
Total labor intensity hours/credits	**108/3**	**108/3**

5. THE CONTENT OF THE DISCIPLINE AND TYPES OF CLASSES

5.1. The content of the discipline (full-time education)

№	The title	Achieved competences	Semester	Types of academic work, including students' self-study and labor intensity (in hours)			
				Lectures	Practical lessons	Practical training	Self-study
1	Subject, methods and significance of genetics. Variation and heredity, methods of its study. Mutational variability.	GPC-2 GPC-2 ID-1 GPC-2 ID-3	1	2	2		2
2	Cytological and molecular bases of heredity.	GPC-2 GPC-2 ID-1 GPC-2 ID-3	1	2		2	2
3	Mitosis, meiosis, gametogenesis.	GPC-2 GPC-2 ID-1 GPC-2 ID-3	1	2	2		2
4	Basic laws of heredity. Chromosomal theory of heredity. Gene structure.	GPC-2 GPC-2 ID-1 GPC-2 ID-3	1	2	2		2
5	The structure of eukaryotic genes. The concept of exons and introns. Alternative splicing.	GPC-2 GPC-2 ID-1 GPC-2 ID-3	1	2	2		2
6	Genetics of the reproductive system. Disorders in sex development.	GPC-2 GPC-2 ID-1	1	2	2		2

		GPC-2 ID-3				
7	Genetics of bacteria.	GPC-2 GPC-2 ID-1 GPC-2 ID-3	1	2	2	2
8	Genetics of viruses.	GPC-2 GPC-2 ID-1 GPC-2 ID-3	1	2		2
9	Genetic basis of ontogenesis. Population genetics.	GPC-2 GPC-2 ID-1 GPC-2 ID-3	1	2	2	2
10	Gynogenesis, androgenesis, parthenogenesis.	GPC-2 GPC-2 ID-1 GPC-2 ID-3	1	2	2	2
11	Genetic disorders in livestock and methods for preventing their spread.	GPC-2 GPC-2 ID-1 GPC-2 ID-3	1	2	2	2
12	Model objects in genetics. Research directions and ethical considerations.	GPC-2 GPC-2 ID-1 GPC-2 ID-3	1	2	2	3
13	Modern genetic engineering techniques.	GPC-2 GPC-2 ID-1 GPC-2 ID-3	1	2	2	3
14	Genome editing systems.	GPC-2	1	2	2	3

		GPC-2 ID-1 GPC-2 ID-3					
15	Gene fingerprinting. Knockout and knockdown of genes. Gene therapy and gene diagnostics techniques.	GPC-2 GPC-2 ID-1 GPC-2 ID-3	1	2	2		3
16	Genomic selection in livestock breeding.	GPC-2 GPC-2 ID-1 GPC-2 ID-3	1	2	2	2	3
17	Animal genetic resources. Criteria for assessing the state of genetic resources.	GPC-2 GPC-2 ID-1 GPC-2 ID-3	1	2		2	3
	Total:			**34**	**28**	**6**	**40**

6. THE LIST OF EDUCATIONAL AND METHODOLOGICAL SUPPORT FOR STUDENTS' SELF-WORK

6.1. Guidelines for self -work

1. Methodological instructions for completing test assignments for students of the correspondence veterinary faculty in the discipline "Veterinary Genetics" / compiled by: P. I. Ukolov, O. G. Sharaskina; Ministry of Agriculture of the Russian Federation, SPbGAVM. - St. Petersburg: Publishing house SPbGAVM, 2013. - 19 p.

6.2. Literature for self-work

1. Nicholas F. W. Introduction to Veterinary Genetics / F. W. Nicholas - Oxford University Press, 1996 – 330 P. - ISBN 9780198542933.
2. Temple G. Genetics and the Behavior of Domestic Animals / G. Temple - Elsevier Science, 2022 - 586 P. - ISBN 9780323857529.

7. THE LIST OF BASIC AND ADDITIONAL LITERATURE NECESSARY FOR THE EDUCATION OF THE DISCIPLINE

A) Basic literature:

1. Krebs J. E., Goldstein E. S., Kilpatrick Lewin's Genes XII / J. E. Krebs, E. S. Goldstein, Kilpatrick - Jones & Bartlett, 2017 – 838 P. - ISBN 9781284104493

б) Additional literature:

1. Passarge E. Color Atlas of Genetics, 5 ed. / E. Passarge - Thieme Verlagsgruppe, 2017 – 474 P. - ISBN: 9783132414402
2. Samuel E. A., Huaijun Z., Michèle T., Douglas D. R. Advances in Poultry Genetics and Genomics / E. A. Samuel, Z. Huaijun, T. Michèle, D. R. Douglas - Burleigh Dodds Science Publishing, 2020 - 580 P. - ISBN 9781003047735

8. THE LIST OF RESOURCES OF THE INFORMATION AND TELECOMMUNICATION NETWORK "INTERNET" NECESSARY FOR EDUCATION OF THE DISCIPLINE

Electronic library systems:

1. ELS «SPbGAVM» (accessed: 04/27/2024)
2. ELS «Lan Publishing House» (accessed: 04/27/2024)
3. Legal reference system «ConsultantPlus» (accessed: 04/27/2024)
4. University information system «RUSSIA» (accessed: 04/27/2024)
5. Scientific electronic Library ELIBRARY.RU (accessed: 04/27/2024)
6. Russian Scientific Network (accessed: 04/27/2024)
7. Database of international scientific citation indexes Web of Science (accessed: 04/27/2024)
8. Full-text interdisciplinary database on agricultural and environmental sciences ProQuest AGRICULTURAL AND ENVIRONMENTAL SCIENCE DATABASE (accessed: 04/27/2024)

To prepare for seminar classes and perform self study, students can use the following Internet resources:

1. http://omia.angis.org.au/home/ (accessed: 04/27/2024)
2. www.vet.ohio-state.edu - Ohio State College of Veterinary Medicine (accessed: 04/27/2024)
3. www.zoology.wisc.edu-сайт - Zoology department of Wisconsin-Madison (accessed: 04/27/2024)

9. METHODOLOGICAL GUIDELINES FOR STUDENTS ON EDUCATION OF THE DISCIPLINE

Methodological recommendations for students are a set of recommendations and explanations that allow them organize the process of studying this discipline optimally.
The content of methodological recommendations, as a rule, may include:

- Tips on planning and organizing the time needed to study the discipline. Description of the sequence of actions of the student, or the «scenario of studying the discipline».

Morning time is the most effective for academic work (from 8-14 hours), followed by afternoon time (from 16-19 hours) and evening time (from 20-24 hours). The most difficult material is recommended to be studied at the beginning of each time interval after rest. After 1.5 hours of work, a break is required (10-15 minutes), after 4 hours of work, the break should be 1 hour. Part of the scientific organization of labor is the master of the technique of mental labor. Normally, a student should devote about 10 hours a day to studying (6 hours at university, 4 hours at home).

- Recommendations for working on lecture material

When preparing for a lecture, the student is advised to:

1) review the recordings of the previous lecture and recall previously studied material;

2) it is useful to browse the material of the upcoming lecture;

3) if independent study of certain fragments of the previous lecture is assigned, then it must be completed without delay;

4) get yourself mentally prepared for the lecture.

This work includes two main stages: taking notes of lectures and subsequent work on lecture material.

The methodology of work when taking notes of oral presentations differs significantly from the methodology of work when taking notes of written sources.

By taking notes of written sources, the student has the opportunity to read again the desired passage of the text, reflect on it, highlight the main thoughts of the author, briefly formulate them, and then write them down. If necessary, he can also note his attitude to this point of view. Listening to the lecture, the student should transist most of the complexity of the above-mentioned works for another time, trying to use every minute to record the lecture, and not to comprehend it - there is no time left for this. Therefore, when taking notes of a lecture, it is recommended, to leave separate fields on each page for subsequent entries in addition to the summary.

After recording a lecture or making a summary of it, you should not leave work on the lecture material before preparing for the test. It is necessary to do as early as possible the work that accompanies takimg notes of written sources, the last could not be done during the recording of the lecture - read your notes, deciphering individual abbreviations, analyze the text, establish logical connections between its elements, in some cases show them graphically, highlight the main thoughts, mark issues, requiring additional processing, in particular, the teacher's consultations.

When working on the text of the lecture, the student should pay special attention to the problematic issues, raised by the teacher, during the lecture, as well as to his assignments and recommendations.

For each lecture, practical lesson and laboratory work, classification cod, topic, list of issues under consideration, volume in hours and links to recommended literature are provided. For classes conducted in interactive forms, its organizational form should be indicated: computer simulation, business or role-playing game, analysis of a specific situation, etc.

Recommendations for preparing for practical classes

Practical (seminar) classes are an important part of the professional training of students. The main purpose of conducting practical (seminar) classes is to form students' analytical, creative thinking through the acquisition of practical skills. Practical classes are also conducted

in order to deepen and consolidate the knowledge gained in lectures and in the process of independent work on normative documents, educational and scientific literature. For student, it is necessary, to study or repeat theoretical material on a given topic when preparing for a practical lesson for students.

When preparing for a practical lesson, the student is recommended to follow the following algorithm:

1) get acquainted with the plan of the upcoming lesson;

2) study the literature sources that have been recommended and familiarize yourself with the introductory notes to the relevant sections.

Methodological guidelines for practical (seminar) classes in the discipline, along with the work program and schedule of the educational process, refer to methodological documents that determine the level of organization and quality of the educational process.

The content of practical (seminar) classes is recorded in the working curricula of the disciplines in the sections "List of topics of practical (seminar) classes".

The most important component of any form of practical training are tasks. The basis of the task is an example that is understood from the standpoint of the theory developed in the lecture. As a rule, the main attention is paid to the formation of specific skills, which determines the content of students' activities - problem solving, laboratory work, clarification of categories and concepts of science, which are a prerequisite for correct thinking and speech.

Practical (seminar) classes perform the following tasks:

- stimulate regular study of recommended literature, as well as attentive attitude to the lecture course;
- consolidate the knowledge gained in the process of lecture training and independent work on literature;
- expand the scope of professionally significant knowledge, skills, and abilities;
- allow you to verify the correctness of previously acquired knowledge;
- initiate skills of independent self-thinking, oral presentation;
- contribute to the free use of terminology;
- provide the teacher with the opportunity to systematically monitor the level of independent work of students.

Methodological guidelines for practical (seminar) classes on the discipline should be focused on modern business conditions, current regulatory documents, advanced technologies, the latest achievements of science, technology and practice, modern ideas about certain phenomena, the studied reality.

• Recommendations for working with literature.

Working with literature is an important stage of the student's self-work on mastering the subject, contributing not only to the consolidation of knowledge, but also to the expansion of horizons, mental abilities, memory, the ability to think, express and confirm personal hypotheses and ideas. In addition, the skills of research work necessary for further professional activityare developed.

When starting to study the literature on the topic, it is necessary to make notes, extracts, notes. It is mandatory to take notes of the works of theorists, which allow us to comprehend the theoretical basis of the study. For the rest, you can limit yourself to summary from the studied sources. All summaries and quotations must have the exact "return address" (author, title of the work, year of publication, page, etc.). It is advisable to write an abbreviated title of the question to which the extract or quotation refers. In addition, it is necessary to learn how to immediately compile a file of special literature and publications of sources, both proposed by the teacher and identified independently, as well as refer to bibliographic reference books, chronicles of journal articles, book chronicles, abstract journals. At the same time, publications of sources (articles, book titles, etc.) should be written on separate cards, which must be filled in according to the rules of bibliographic description (surname, initials of the author, title of the work. Place of publication, publisher, year of publication, number of pages, and for journal articles – the name

of the journal, year of publication, page numbers). On each card, it is advisable to record the thought of the author of the book or a fact from this book on only one specific issue. If the work, even in the same paragraph or phrase, contains more judgments or facts on another issue, then they should be written out on a separate card. The presentation should be concise, accurate, without subjective assessments. On the back of the card, you can make your own notes about this book or article, its content, structure, on which sources it is written, etc.• Explanations about working with control and test materials for the course, recommendations for completing homework.

Testing allows one to determine whether the actual behavior of the program corresponds to the expected one by performing a specially selected set of tests. A test is the fulfillment of certain conditions and actions necessary to verify the operation of the function under test or part of it. Each question in the discipline must be answered correctly by choosing one option..

10. EDUCATIONAL SOCIAL WORK

As part of the implementation of the discipline, educational work is carried out to form a modern scientific worldview and a system of basic values, the formation and development of spiritual and moral, civil and patriotic values, a system of aesthetic and ethical knowledge and values, attitudes of tolerant consciousness in society, the formation of students' need for work as the first vital necessity, the highest value and the main way to achieve success in life, to realize the social significance of your future profession.

11. THE LIST OF INFORMATION TECHNOLOGIES USED IN THE IMPLEMENTATION OF THE EDUCATIONAL PROCESS

11.1 Information technologies

For the educational process of the discipline is previewed the use of information technologies:

Educational process involves the following information technologies::

- ✓ use of multimedia when conducting seminars;
- ✓ interactive technologies (dialogue and collective discussion of various approaches to solving a particular educational and professional problem);
- ✓ interaction via email;
- ✓ collaboration in the Electronic educational environment (EIOS SPbGUVM): https://spbguvm.ru/academy/eios/ (accessed: 04/27/2024)

11.2. Software

The list of licensed and free- distributed software, including national programs

№	Technical and computer programs recommended by sections and topics of the program	License
1	MS PowerPoint	67580828
2	LibreOffice	free software
3	OS ALT Education 8	AAO.0022.00
4	MARC-SQL Library Management Systems Line	02102014155
5	MS Windows 10	67580828
6	Consultant Plus System	503/КЛ
7	Android ОС	free software

11. THE MATERIAL AND TECHNICAL BASE NECESSARY FOR THE IMPLEMENTATION OF THE DISCIPLINE EDUCATIONAL PROCESS.

The title of the discipline (module), practice in accordance with the curriculum	The title of special rooms and rooms for self-work	Equipment of special rooms and rooms for self-work
Veterinary genetics	335 (Saint Petersburg, st. Chernigovskaya, 5, 196084) Classroom for conducting seminars, consultations and course assessment	*Specialized furniture:* tables, chairs multimedia screen.
	214 (Saint Petersburg, st. Chernigovskaya, 5, 196084) Classroom for conducting seminars, consultations and course assessment	*Specialized furniture:* tables, chairs табуреты, multimedia screen.
	221 (Saint Petersburg, st. Chernigovskaya, 5, 196084) Classroom for conducting seminars, consultations and course assessment	*Specialized furniture:* tables, chairs *Technical means of education:* multimedia screen.
	206 Big reading room (Saint Petersburg, st. Chernigovskaya, 5, 196084) Room for independent work	*Specialized furniture:* tables, chairs *Technical teaching aids:* computers with an Internet connection and access to the electronic information and electronic educational environment
	214 Small reading room (Saint Petersburg, st. Chernigovskaya, 5, 196084) Room for independent work	*Specialized furniture:* tables, chairs *Technical means of education:* computers with an Internet connection and access to the electronic information and electronic educational environment
	324 Information technology department (Saint Petersburg, st. Chernigovskaya, 5, 196084) Room for storage and preventive maintenance of educational equipment	*Specialized furniture:* tables, chairs, special equipment, materials and spare parts for preventive maintenance of educational equipment

	Box №3 Carpentry workshop (Saint Petersburg, st. Chernigovskaya, 5, 196084) Room for storage and preventive maintenance of educational equipment	*Specialized furniture:* tables, chairs, special equipment, materials and spare parts for preventive maintenance of educational equipment.
	Molecular genetics laboratory (Saint Petersburg, st. Chernigovskaya, 5, 196084) Room for storage and \maintenance of molecular genetic equipment	*Specialized equipment for molecular genetic research and furniture:* tables, chairs, special equipment

Developers:

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Annex 1

Ministry of Agriculture of the Russian Federation
Federal State Budgetary Educational Institution
of higher education
«Saint Petersburg State University of Veterinary Medicine»

Department of Genetic and Reproductive Biotechnologies

FUND OF ASSESMENT TOOLS
for the discipline
«Veterinary genetics»

Level of higher education
SPECIALIST COURSE

Specialty 36.05.01 Veterinary medicine
Full-time education.

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1. PASSPORT OF THE FUND OF ASSESMENT TOOLS

Table 1

№	Acquired competence	Assessed modules of a discipline	Assesment tool
1	GPC-2 GPC-2 ID-1 GPC-2 ID-3	Section 2. The chromosomal basis of inheritance	Seminar, test
2		Section 3. Patterns of inheritance	Seminar, test
3		Section 4. Gene structure in eukaryotes and prokaryotes.	Seminar, test
4		Section 5. Methods of genetic engineering	Seminar, test
5		Section 8. Genetic disorders in livestock and its prevention.	Essay

2.List of assessment tools

Table 2

№	Name of the assessment tool	Brief description of the assesment tool	Presentation of the assessment tool in the fund
1.	Essay	Product of student's independent work. A brief written summary of specific scientific (educational and research) topic theoretical analysis result, where the author reveals the essence of the problem, gives various points of view, as well as his own interpretation.	List of essay topics
2.	Seminar	A mean of control is organized as a conversation between the teacher and the student on topics related to the discipline	Questions on topics/modules of the discipline
3.	Test	A system of standardized tasks, which allows to automate the assessment of students' knowledge and skills	A fund of test assignments

1. INDICATORS AND CRITERIA FOR ASSESSING COMPETENCIES AT VARIOUS STAGES OF ITS FORMATION, DESCRIPTION OF ASSESSMENT SCALES

Table 3

Planned results of competency acquaired	The level of development				Assesment tool
	Unsatisfactory	Satisfactory	Good	Excellent	
GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body.)					
GPC-2 ID-1 To know: ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body.	The level of knowledge is below the minimum requirements, gross errors have occurred	The minimum acceptable level of knowledge, many minor errors have been made	The level of knowledge corresponds to the training program, several minor errors have been made	The level of knowledge corresponds to the training program, no errors have been made	Seminar, test, essay
GPC-2 ID-3 To possess skills of: the knowledge of the origin of living organisms, the levels of organization of living matter, favorable and unfavorable factors affecting the body; the basis for studying environmental knowledge of the environment, the laws of the	The level of knowledge is below the minimum requirements, gross errors have occurred	The minimum acceptable level of knowledge, many minor errors have been made	The level of knowledge corresponds to the training program, several minor errors have been made	The level of knowledge corresponds to the training program, no errors have been made	Seminar, test, essay

development of nature and society; skills of observation, comparative analysis, historical and experimental modeling of the impact of anthropogenic and economic factors on living objects, with the use of digital technologies as well.					

3. A LIST OF CONTROL TASKS AND OTHER MATERIALS, NECESSARY FOR THE ASSESSMENT OF KNOWLEDGE, SKILLS AND WORK EXPERIENCE

3.1. Typical tasks for the current control of academic progress

3.1.1. Seminar questions

Questions to assess competency:
GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body.
Questions for the seminar №1
Indicator GPC-2 ID-1
1. Chromosomes: structure, morphology, and composition. Classification of chromosomes based on the position of the centromere.
2. Structure and function of telomeres. The Hayflick limit.
3. Telomere structure. Histone protein structure.
4. Levels of chromatin compaction.
5. Chromatin remodeling in eukaryotes.
6. Difference between euchromatin and heterochromatin. Types of heterochromatin. Composition of heterochromatin.
7. Mobile genetic elements in eukaryotes.
8. Definition of karyotyping. Karyogram definition. Metaphase plate definition.
9. Standard karyotype of cattle.
10. Standard karyotypes of small ruminants.
11. Standard karyotype of the domestic horse.
12. Standard karyotype of the domestic pig.
13. Main features of avian karyotypes. Standard karyotype of the domestic chicken.
14. Definition, procedure and applications of karyotyping.
15. Chromosome banding techniques.
16. Systems of chromosome classification and nomenclature.
17. Метод FISH и его роль в изучении кариотипов продуктивных животных.
18. Cell division. Mitosis. Biological significance of mitosis.
19.Meiosis. Biological significance of meiosis.
20.Gametogenesis. Stages. Differences between spermatogenesis and oogenesis.
21.RNA: structure, types, function.
22.Non-coding RNAs.
23.Structural and functional differences between DNA and RNA.
24.Transfer RNA (t-RNA): structure and functions
25.DNA replication.
26.DNA replication enzymes.
27. DNA damage types.
28. Direct reversal repair in eukaryotes.
29. Base excision repair and its main steps.
30.Stages of protein synthesis.
31.Transcription, pre-mRNA processing.
32. RNA processing and its stages.
33. Post-translational modification of proteins.
34.Cell types in relation to proliferative potential.
35.Types of cell division.
36.Atypical mitosis.

37.Endoreduplication.

Indicator GPC-2 ID-3
38.Mendel's principles of inheritance.
39.Types of genetic crosses.
40.Modes of inheritance.
41.Classification of mutations.
42.Types of chromosomal abnormalities.
43.Watson-Crick Structure of DNA.
44.DNA polymorphism.
45.Definition of chromosomal territories..
46.Kinetochore: definition and function
47.Types of dominance.
48.The role of microtubules in chromosome segregation during mitosis/meiosis.
49.Variations in sex characteristics.
50.Types of variation.
51.Gene, genome and chromosome mutations.
52.Mutagens and antimutagens.
53.Chromosomal theory of inheritance.
54.Modern concept of gene structure.
55.The structure of eukaryotic genes.
56. Chromosomal territories.
57. Non-coding RNAs.
58. Alternative splicing.
59. Function of the kinetochore.
60. Types of kinetochore microtubule attachments.

Questions for the seminar №2
Indicator GPC-2 ID-1
1. Non-allelic gene interactions.
2. Epistasis and complementation.
3. Pleiotropy and polygenic inheritance.
4. Modifier genes.
5. Intersexuality definition.
6. Freemartinism in cattle.
7. Hermaphroditism: definition, types and examples.
8. Genomic imprinting.
9. Klinefelter syndrome.
10. Turner syndrome.
11. Jacobs syndrome.
12. Triple X syndrome.
13. Gynandromorphism: definition and examples.
14. Definition of chimerism and mosaicism.
15. Viral genome organization.
16. Viral life cycle.
17. Bacterial genome structure.
18. Plasmid classifications and their biological significance.
19. Antibiotic resistance in bacteria.

20. Operon: definition, function and examples.
21. Gene expression during ontogenesis.
22. The driving forces of evolution.
23. Definition of population. Characteristics of popualtions.
24. Modes of speciation.
25. Definition of macroevolution.
26. Evolutionary dynamics of group formation.
27. Paths of evolution.
28. The Hardy-Weinberg equilibrium and its assumptions.
29. Parthenogenesis: definition, examples and usage.
30. Types parthenogenesis.
31. Definition of gynogenesis and androgenesis.
32. Sex inversion in fish. Sex control and manipulation in fish.
33. Polymerase chain reaction (PCR) and its use.
34. Components required for PCR. PCR basic protocols.
35. PCR primer design.
36. Types of PCR.

Indicator GPC-2 ID-3
37. Gene mutations.
38. Genetic disorders in cattle.
39. Genetic disorders in domestic pig.
40. Genetic disorders in small ruminant.
41. Avian genetic disorders.
42. Genetic disorders in domestic horse.
43. Genetic Disorders in arabian horses
44. Causes of congenital anomalies:
45. Definition of transformation in bacteria.
46. Definition of bacterial conjugation.
47. Definition of transduction in bacteria.
48. Model organisms in genetics.
49. Genetic engineering, its techniques and applications.
50. Strategies for gene delivery (at least three).
51. Cloning and genetic engineering.
52. Genome-editing and its application.
53. Genome-editing technologies.
54. DNA Fingerprinting.
55. Gene therapy and genomic-based diagnostic.
56. Genomic selection.
57. Genome-wide SNP detection. DNA microarray.
58. Genomic selection for livestock breeding.
59. Gene mapping.
60. Animal genome databases.

3.1.2. Tests

Formed competence:
GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body.
GPC-2 ID-1 To know: ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body.
GPC-2 ID-3 To possess skills of: the knowledge of the origin of living organisms, the levels of organization of living matter, favorable and unfavorable factors affecting the body; the basis for studying environmental knowledge of the environment, the laws of the development of nature and society; skills of observation, comparative analysis, historical and experimental modeling of the impact of anthropogenic and economic factors on living objects, with the use of digital technologies as well.

«The chromosomal basis of inheritance» section:

«Karyotype»

Variant 1

The chromosome of the second pair in a pig has an absolute length of 2.8 μm and length of long arm is 2.1 μm.

1) How many pairs of homologous chromosomes do pig somatic cells contain?
1) 38
2)16
3) 19
4) 46

2) What is the ratio of the chromosome arms?
1) 33
2) 3
3) 0.33
4) 3.3

3) What is the centromeric index value of the chromosome?
1) 25
2) 75
3) 0.25
4) 0.75

4) How many chromosomes does a horse karyotype contain?
1) 32
2) 64
3) 66
4) 12

5) How many acrocentric chromosomes does a pig karyotype contain?
1) 6
2) 12
3) 24
4) 1

«Karyotype»
Variant 2
The chromosome of the first pair in the karyotype of a domestic horse has an absolute length of 4.2 μm and a short arm length of 1.8 μm.

1) What is the centromeric index value of the chromosome?
1) 57.1
2) 42.9
3) 75.0
4) 2.33

2) What is the ratio of the chromosome arms?
1) 133
2) 0.75
3) 1.33
4) 75.0

3) What shape does this chromosome have?
1) metacentric
2) acrocentric
3) submetacentric
4) telocentric

4) How many double-armed chromosomes does a mare's karyotype contain?
1) 13
2) 26
3) 28
4) 14

5) How many chromosomes does a cattle ovum contain?
1) 20
2) 19
3) 30
4) 60

«Karyotype»
Variant 3
The total length of all chromosomes of the pig karyotype is 37.5 μm, absolute length of the X chromosome is 1.6 μm; length of one arm is 0.8 μm.

1) What is the relative length of the X chromosome?
1) 43.125
2) 2.0
3) 0.213
4) 2.13

2) What is the centromeric index value of the X chromosome?
1) 25
2) 50
3) 0.5
4) 100

3) What is the ratio of the X.chromosome arms?
1) 50
2) 2
3) 1
4) 0.5

4) How many sex chromosomes does a boar spermatozoa have?
1) 2
2) 3
3) 1
4) 4

5) What shape does the Y chromosome of a pig have?
1) acrocentric
2) metacentric
3) submetacentric
4) satellite

«Meiosis»
Variant 1

1) In which phase of meiosis does conjugation occur?
    1) diakinesis
    2) zygonema
    3) pachynema
    4) diplonema
2) In which phase of meiosis, the chromosomes are at the center of the cell?
    1) anaphase 1
    2) anaphase 2
    3) prophase 1
    4) prophase 2
3) How many chromosomes are contained in ovum of a cow?
    1) 60
    2) 20
    3) 15
    4) 30
4) How many chromatids do pig somatic cells contain in metaphase 1?
    1) 38
    2) 76
    3) 19
    4) 114
5) When do bivalents form?
    1) metaphase 1
    2) prophase1
    3) metaphase 2
    4) prophase 2
6) How many different types of gametes can be formed as a result of a random combination of paternal and maternal homologous chromosomes during meiosis in cattle (specify the exponent).
    1) 15
    2) 10
    3) 30
    4) 60

«Meiosis»

Variant 2

1) When chromosomes consist of 2 chromatids and look like long thin threads?
   1) zygonema
   2) leptonema
   3) diakinesis
   4) pachynema
2) When does chiasmata begin to form?
   1) diplonema
   2) leptonema
   3) pachynema
   4) zygonema
3) How many chromosomes does a pig ovum contain?
   1) 30
   2) 60
   3) 15
   4) 29
4) In what phase of meiosis do chromosomes already consist of 2 chromatids?
   1) anaphase 1
   2) prophase 1
   3) metaphase 2
   4) telophase 2
5) In which phase of meiosis does separation of chromosomes to the opposite poles occur?
   1) anaphase 2
   2) metaphase 1
   3) anaphase 1
   4) metaphase 2
6) How many bivalents can be formed in sheep cell?
   1) 108
   2) 27
   3) 54
   4) 37

«Mitosis»

Variant 1

1) In which period of interphase does the cell's genetic material double?
   1) S
   2) G1
   3) G2
   4) G0
2) How many chromosomes do bovine somatic cells have in anaphase?
   1) 30
   2) 60
   3) 20
   4) 40
3) In which phase of mitosis the chromosomes already composed of 2 chromatids?
   1) anaphase
   2) telophase
   3) metaphase
   4) prophase
4) In which phase of mitosis does the despiralization of chromosomes ends?
   1) telophase
   2) metaphase
   3) prophase

4) anaphase

5) How many chromatids do pig somatic cells have in metaphase?

1) 38
2) 19
3) 76
4) 30

6) In which period of the cell cycle does DNA replication occur?

1) prophase
2) telophase
3) interphase
4) interkinesis

«Mitosis»

Variant 2

1) In which phase of mitosis does the division of cytoplasm and organelles between daughter cells begin?

1) telophase
2) interphase
3) anaphase
4) prophase

2) In which phase of mitosis do chromosomes have the most clearly defined morphological structure?

1) anaphase
2) telophase
3) metaphase
4) prophase

3) At the beginning of which phase of mitosis do chromosomes begin to move toward the poles?

1) telophase
2) anaphase
3) prophase
4) metaphase

4) What period of interphase precedes the replication of a DNA strand?

1) G1
2) S
3) G2
4) M

5) In what phase of mitosis does complete restoration of the nucleus occur?

1) anaphase
2) telophase
3) metaphase
4) prophase

6) How many chromatids do pig somatic cells have in metaphase?

1. 38
2. 72
3. 19
4. 60

«Patterns of Inheritance» section:

«Monohybrid crosses»

Variant 1

1) Crossing an F1 hybrid with a parental form that is homozygous for the corresponding pair of alleles is called:

1) testcross

2) backcross
3) reciprocal cross
4) hybridization

2) The dominant gene of Karakul sheep in a heterozygous state causes gray coloration of fur, and is lethal in a homozygous state. The recessive allele of this gene causes black fur color. When crossing gray sheep with a gray ram, 72 lambs were obtained. How many types of gametes can a gray sheep produce?

1) 2
2) 1
3) 4
4) 3

3) How many living lambs can have gray fur?

1) 54
2) 36
3) 18
4) 9

4) How many black lambs can be obtained?

1) 18
2) 36
3) 9
4) 54

5) How many homozygous lambs will be alive?

1) 9
2) 36
3) 18
4) 1

6) How many were stillborn lambs?

1) 54
2) 9
3) 36
4) 18

«Monohybrid crosses»

Variant 2

1) Crested ducks are heterozygous for the A locus, which in the homozygous state causes embryonic death. The recessive allele of this locus determines the normal development of the trait. 36 eggs were obtained from crossing crested ducks and drakes. How many types of gametes can a crested duck produce?

1) 2
2) 4
3) 1
4) 3

2) How many ducklings did not hatch from the eggs?

1) 18
2) 9
3) 4
4) 27

3) How many ducklings will be crested?

1) 9
2) 30
3) 18
4) 48

4) How many eggs must be placed in the incubator to get 36 ducklings?

1) 36
2) 72
3) 40
4) 48

5) How many hatched ducklings will have a homozygous genotype?

1) 18
2) 27
3) 9
4) 3

6) Two experimental crossings - direct and reverse - characterized by a directly opposite combination of sex and the trait under study

1) reciprocal cross
2) testcross
3) backcross cross
4) variable cross

«Monohybrid crosses»

Variant 3

1) The manifestation of an intermediate phenotypic character in F1 hybrids (for example, the pink color of snapdragon flowers in F1, when crossing plants with white and red flowers) is called:

1) co-dominance
2) incomplete dominance
3) complete dominance
4) hybridization

2) In dogs, black coat color is dominant over brown coat color. A brown female, both of whose parents were black, mated several times with a heterozygous black male, resulting in 12 pups. How many types of gametes can a brown female produce?

1) 2
2) 1
3) 4
4) 3

3) How many puppies could be brown?

1) 12
2) 6
3) 3
4) 9

4) How many types of gametes can a black male dog?

1) 2
2) 1
3) 3
4) 4

5) How many of the 8 puppies obtained from crossing a given male with another heterozygous female can be brown?

1) 4
2) 8
3) 2
4) 6

6) How many puppies in this cross could be heterozygous?

1) 4
2) 2
3) 1

4) 3

«Monohybrid crosses»
Variant 4

1) By crossing standard dark brown minks with ermine colored ones all hybrids in F1 were grey. When grey minks mated with each other, 128 puppies were obtained in F2. How many types of gametes can a grey mink produce?
1) 2
2) 1
3) 4
4) 3

2) How many types of gametes can a ermine colored mink produce?
1) 2
2) 3
3) 1
4) 4

3) How many different genotypes can F2 puppies have?
1) 2
2) 3
3) 4
4) 1

4) How many puppies in F2 will be ermine colored?
1) 32
2) 64
3) 96
4) 16

5) How many puppies in F2 will be grey?
1) 32
2) 64
3) 96
4) 16

6) What is the simultaneous manifestation of certain characteristics called (for example, roan color in cows, due to the presence of white and red hair on the body)?
1) complete dominance
2) co-dominance
3) incomplete dominance
4) hybridization

«Monohybrid crosses»
Variant 5

1) Crosses of an F1 hybrid with a parental form homozygous for the recessive allele is called...
1) backcrossing cross
2) reciprocal cross
3) analysis cross
4) test cross

2) Chickens with a rose-shaped and a simple comb were crossed. In F1 we received 20 chickens (all with a rose comb), in F2 - 48. How many different genotypes can be formed in F2?
1) 1
2) 2
3) 3
4) 4

3) How many chicks in F2 could have a simple comb?
1) 12

2) 24
3) 36
4) 48

4) How many different phenotypes could be in F2?
1) 2
2) 3
3) 4
4) 1

5) How many rose comb F2 chicks could be heterozygous?
1) 2
2) 24
3) 12
4) 36

6) When crossing F1 hens with purebred roosters with a simple comb shape, 56 chickens were obtained. How many of them could have a rose comb?
1) 14
2) 28
3) 42
4) 7

«Di- and polyhybrid crosses»

Variant 1

1) In pigs, the black of the Large Black is dominant over the red of the Duroc, and syndactyly is dominant over the normal legs. Purebred Large Black fused-toed pigs were crossed with a Duroc boar. From this crossing, 144 piglets were obtained in F1, and 720 piglets in F2. How many types of gametes can an F1 pig produce?
1) 4
2) 3
3) 2
4) 1

2) How many different genotypes can F2 piglets have?
1) 19
2) 18
3) 16
4) 3

3) How many F2 piglets could be red and have syndactyly?
1) 3
2) 135
3) 45
4) 405

4) How many F2 piglets could be red with normal legs?
1) 135
2) 45
3) 405
4) 3

5) How many black piglets with syndactyly in F2 could be homozygous?
1) 45
2) 135
3) 405
4) 3

6) How many types of gametes does a red pig with normal legs produce?
1) 4
2) 3

3) 2
4) 1

«Di- and polyhybrid crosses»
Variant 2

1) In chickens, the recessive gene for short legs has a lethal effect, the dominant gene F in the homozygous state determines the development of curly feathers, in the heterozygous state it causes wavy feathers, and in the recessive state it causes smooth (normal) plumage. As a result of crossing heterozygous hens and roosters, 288 live chickens were obtained. How many types of gametes can a chicken produce?
1) 4
2) 3
3) 2
4) 1

2) How many different phenotypes can living chickens have?
1) 1
2) 3
3) 2
4) 4

3) How many chickens could be recessive homozygotes for short legs and die during incubation?
1) 24
2) 96
3) 18
4) 36

4) How many chickens can have short legs and curly feathers?
1) 18
2) 24
3) 0
4) 1

5) How many chickens can have normal legs and smooth feathers?
1) 18
2) 96
3) 72
4) 24

6) How many eggs must be incubated to produce 288 live chicks?
1) 288
2) 312
3) 384
4) 334

«Di- and polyhybrid crosses»
Variant 3

1) The long hair of persian cats is recessive to the short hair of siamese cats, and the black coat color of the persian breed is dominant to the fawn point color of the siamese breed. When crosses a persian cat with a siamese cat F1 kittens were born and then 16 F2 kittens. How many F1 kittens have short black hair?
1) 4
2) 3
3) 2
4) 1

2) How many types of gametes can an F1 cat produce?

1) 1
2) 2
3) 3
4) 4

3) How many kittens in F2 will have the same characteristics as a siamese cat?
1) 9
2) 3
3) 1
4) 8

4) How many F2 kittens could look like a persian cat?
1) 8
2) 3
3) 1
4) 9

5) How many F2 kittens had long fawn point color coat?
1) 9
2) 3
3) 1
4) 8

6) How many types of gametes will a long fawn point color coat cat produce?
1) 4
2) 3
3) 2
4) 1

«Di- and polyhybrid crosses»

Variant 4

1) In cows, the polled allele dominates the horned allele, and the red color dominates the white color. In the Shorthorn breed there is codominance by color and heterozygous animals have a roan color (red and white). When crossing homozygous polled white cows with a homozygous horned red bull, 6 animals were obtained in F1, and 32 in F2. How many different types of gametes can a cow from F1 produce?
1) 1
2) 2
3) 3
4) 4

2) How many genotypes could be found in F2?
1) 1
2) 2
3) 4
4) 9

3) How many phenotypes could be found in F2?
1) 9
2) 2
3) 4
4) 3

4) How many animals in F2 could be polled?
1) 24
2) 8
3) 18
4) 6

5) How many animals in F2 could be horned?
1) 24

2) 8
3) 18
4) 6

6) How many white horned animals could be in F2?

1) 1
2) 2
3) 3
4) 9

«Di- and polyhybrid crosses»

Variant 5

1) In guinea pigs having rosettes dominates over smooth fur, and black fur color dominates over white. Animals that heterozygous for both traits were crossed several times with the same diheterozygous animals. 32 offspring were obtained. How many different types of gametes can a double heterozygous pig produce?

1) 1
2) 2
3) 3
4) 4

2) How many phenotypes could be form in such cross?

1) 2
2) 9
3) 4
4) 10

3) How many phenotypes could be found?

1) 2
2) 9
3) 4
4) 10

4) How many hybrids could have smooth black coat?

1) 3
2) 9
3) 1
4) 8

5) How many hybrids could have rosette black coat?

1) 3
2) 9
3) 1
4) 8

6) How many different phenotypes would be observed when crossing a diheterozygous guinea pig with a homozygous recessive animal?

1) 1
2) 2
3) 3
4) 4

«Inheritance of traits and gene interaction»

Variant 1

1) The phenomenon in which one gene determines the development and phenotypic manifestation of several traits is called...

1) pleiotropy
2) penetrance
3) complementarity
4) modification

2) In Leghorn chickens, the dominant allele C causes the plumage to be black, and allele c- forms white coat. Gene I suppresses pigment development, and its recessive i allele has no effect on pigment development. Homozygous chickens with black plumage and genotype ccII were crossed. In F1 we got 132 hybrids, in F2 - 432. How many hybrids in F1 could have white plumage?

1) 33
2) 136
3) 66
4) 132

3) How many phenotypes could be found?

1) 1
2) 2
3) 3
4) 4

4) How many F2 hybrids could have white plumage?

1) 432
2) 341
3) 27
4) 81

5) How many of them could produce F3 hybrids with black plumage?

1) 341
2) 162
3) 54
4) 27

6) How many black-feathered F2 hybrids could be homozygous?

1) 27
2) 54
3) 162
4) 341

«Inheritance of traits and gene interaction»

Variant 2

1) Non-allele genes that, when combined together in a genotype in a homozygous or heterozygous state, cause a new phenotypic manifestation of a trait are called...

1) epistatic
2) complimentary
3) pleiotropic
4) modifying

2) In Drosophila, eye color is inherited in a complementary manner. The combination of 2 dominant non-allele genes causes the red color of the eyes: homozygous recessive genotype – white; aaB – bright red; A_vv – brown. F1 flies with red eyes were crossed with flies with white eyes. 196 F2 offspring were obtained. How many genotypes are present among the hybrids?

1) 4
2) 3
3) 2
4) 1

3) How many phenotypes could be found?

1) 1
2) 2
3) 3
4) 4

4) How many flies can have red eyes?

1) 78

2) 49
3) 147
4) 98

5) How many flies can have brown eyes?
1) 147
2) 78
3) 98
4) 49

6) How many flies can have white eyes?
1) 98
2) 147
3) 49
4) 78

«Inheritance of traits and gene interaction»

Variant 3

1) The unambiguous influence of 2, 3 or more non-allele genes on the development of the same trait is called...
1) epistasis
2) polygenic inheritance
3) complementation
4) pleiotropy

2) In horses, the dominant allele C determines the gray color and suppresses the dominant gene B, which determines the black color, and the b allele, which determines the red color. The recessive allele c does not affect the appearance of coat color in horses. From crossing gray horses with the genotype in CCBB with red horses, 8 offspring in F1 were obtained, from mating of which with each other in different years 16 offspring F2 were obtained. How many F1 hybrids could be gray?
1) 2
2) 4
3) 8
4) 6

3) How many different phenotypes can F2 horse have?
1) 4
2) 3
3) 2
4) 1

4) How many F2 hybrids could be gray?
1) 16
2) 12
3) 9
4) 3

5) How many of them could produce homogeneous offspring in F3?
1) 1
2) 3
3) 9
4) 12

6) What type of gene interaction appears in this case?
1) complementation
2) epistasis
3) polygenic inheritance
4) neoplasm

«Inheritance of traits and gene interaction»

Variant 4

1) The interaction of non-allele genes, in which one of them suppresses the expression of the other, is called...
   1) polygenic inheritance
   2) complementation
   3) epistasis
   4) neoplasm

2) The length of the ears in lop-eared rabbits is 28 cm, in other breeds it is about 12 cm. Let us assume that differences in ear length depend on 2 pairs of genes with an unambiguous effect. Each dominant gene increases the length of the ears by 14 cm. Purebred lop-eared rabbits were crossed with ordinary rabbits. In F1 we got 14 rabbits, in F2 - 32. What is the length of the ears of rabbits in F1?
   1) 28
   2) 20
   3) 12
   4) 14

3) How many different genotypes can F2 rabbits have?
   1) 9
   2) 16
   3) 1
   4) 3

4) How many different phenotypes can F2 rabbits have?
   1) 9
   2) 5
   3) 3
   4) 4

5) How many F2 rabbits will have the same ear length as lop-eared rabbits?
   1) 2
   2) 1
   3) 4
   4) 8

6) How many F2 rabbits can have the same ear length as F1 rabbits and produce homogeneous offspring?
   1) 8
   2) 2
   3) 1
   4) 4

«Inheritance of traits and gene interaction»

Variant 5

1) Genes that do not exhibit their own action, but enhance or weaken the effect of other genes, are called...
   1) epistatic
   2) hypostatic
   3) oligogens
   4) modifiers

2) In chickens, the rose-shaped and pod-shaped forms of the comb are determined by the P and C genes, respectively, and are dominant in relation to the simple form. When the dominants P_C_ are combined in the genotype, the shape of the comb will be nut-shaped. From crossing purebred hens with a rose-shaped comb with roosters having a pod-shaped comb. F1 received 120 chickens, F2 - 544. How many chickens in F1 could have a nut-shaped comb?
   1) 60
   2) 120

3) 30
4) 20

3) What is the type of gene interaction in this case?
1) epistasis
2) polygenic
3) complementation
4) pleiotropy

4) How many hybrids of F2 could have had a pod-shaped comb?
1) 34
2) 136
3) 272
4) 102

5) How many hybrids of F2 offspring that have a nut-shaped comb could be diheterozygous?
1) 136
2) 34
3) 102
4) 272

6) How many hybrids of F2 could have a simple comb?
1) 272
2) 102
3) 34
4) 136

«Linked inheritance of traits» section:

Variant 1

1) In Drosophila, the genes cl—dark brown eyes and ci—curved wings—are localized on chromosome 2. These genes are recessive in relation to the dominant genes Cl - red eyes and Ci - normal wings. Flies that had both traits in a recessive state were crossed with flies that had dominant traits. In F1, 60 flies were obtained, in F2 240 flies were obtained. How many flies in F1 could have all the traits in the dominant state?
1) 60
2) 30
3) 15
4) 20

2) How many F2 flies could have all the traits in a dominant state and produce homogeneous offspring?
1) 30
2) 60
3) 120
4) 240

3) How many flies in F2 had both genes in a heterozygous state?
1) 60
2) 180
3) 120
4) 240

4) How many different phenotypes could be found in F2?
1) 4
2) 3
3) 2
4) 1

5) How many types of gametes can an F1 fly form?
1) 4

2) 3
3) 2
4) 1

6) Genes located on the same chromosome form one linkage group and are inherited together, and the number of linkage groups is equal...
1) diploid set of chromosomes
2) number of double-armed chromosomes
3) triploid set of chromosomes
4) haploid set of chromosomes

«Linked inheritance of traits»

Variant 2

1) In cats, one pair of alleles (B and c), which determine coat color, is sex-linked. Gene B causes red hair color to appear, gene b causes black coat color to appear, heterozygotes have tortoiseshell coat. From the mating of a black male cat with a red female cat, six kittens were obtained, of which 4 were females. How many kittens were red?
1) 3
2) 4
3) 2
4) 1

2) How many kittens were tortoiseshells?
1) 4
2) 3
3) 2
4) 1

3) How many male kittens were red?
1) 2
2) 1
3) 4
4) 3

4) From the mating of red male cat with black female cats, 8 kittens were obtained, of which 6 were females. How many female kittens were tortoiseshells?
1) 3
2) 6
3) 4
4) 2

5) How many kittens were black?
1) 2
2) 1
3) 6
4) 4

6) When crossing a white blue-eyed male and a black brown-eyed female, in F1 all the offspring turned out to be black brown-eyed. In F2, out of 24 offspring, 12 were black brown-eyed, 10 were white blue-eyed, 1 was black blue-eyed and 1 was white brown-eyed. What caused the appearance of individuals with phenotypes different from the parental forms?
1) chromosome mutation
2) gene recombination during gametogenesis
3) modification variability
4) mendelian inheritance

«Linked inheritance of traits»

Variant 3

1) In chickens, the recessive allele of the gene k is inherited in a sex-linked manner. If the zygote does not contain the dominant allele of the K gene, then the chickens die before hatching from

the egg. A male homozygous for this gene was crossed with normal females. The eggs hatched into 72 chicks. How many different genotypes can there be as a result of such a cross?

1) 4
2) 3
3) 2
4) 1

2) How many chicks can die before hatching?

1) 39
2) 18
3) 24
4) 26

3) How many female chicks could be among the dead?

1) 18
2) 24
3) 12
4) 39

4) How many live male chicks could be born from such crossing?

1) 24
2) 52
3) 39
4) 26

5) How many live female chicks could be born from such crossing?

1) 39
2) 18
3) 12
4) 24

6) How many phenotypes will there be in the F2 offspring of two diheterozygous rabbits with gray fur and white fat, provided that the genes responsible for the color of fur and fat are localized in the chromosomes of the 1st pair?

1) 4
2) 3
3) 2
4) 1

«Linked inheritance of traits»

Variant 4

1) In rabbits, the recessive gene b, which determines the brown color, and the dominant gene B, which determines the gray color of the fur, the recessive gene y, which determines the yellow color of the fat, and Y - the white fat, are localized in the chromosomes of the first pair. A rabbit from a line with gray fur and yellow fat was crossed with a line that had brown coloring and white fat. In F1 we got 12 animals, in F2 - 42. How many types of gametes can the F1 hybrid form?

1) 4
2) 3
3) 2
4) 1

2) How many F1 animals can have gray fur and white fat?

1) 6
2) 3
3) 4
4) 12

3) How many different genotypes could be found in F2?

1) 1

2) 2
3) 3
4) 4

4) How many F2 hybrids could have gray coloring and yellow fat?
1) 42
2) 21
3) 12
4) 0

5) How many F2 hybrids could have brown fur and white fat?
1) 0
2) 12
3) 21
4) 42

6) What could cause an individual with gray fur and white fat to appear?
1) independent inheritance of the traits
2) mutation
3) conjugation
4) chromosomal crossover

«Linked inheritance of traits»

Variant 5

1) In rabbits, spotted (English spot) color dominates over solid color, and short hair dominates over long hair (Angora). From crossing rabbits that have a solid color type and long hair with rabbits that have both dominant traits in F1, 124 hybrids were obtained, and as a result of analytical crossing, 468 F2 animals were obtained, of which 48 were crossovers. How many F1 rabbits will be short-haired and of the English color type?
1) 62
2) 0
3) 31
4) 124

2) How many F2 rabbits could have short hair and English color type?
1) 210
2) 48
3) 234
4) 24

3) How many F2 rabbits could have long hair and English coloration?
1) 234
2) 210
3) 24
4) 48

4) How many different genotypes may be in F2?
1) 4
2) 3
3) 2
4) 1

5) What is the distance in morganids between the genes that determine the color type and fur length in rabbits?
1) 5, 10
2) 10, 30
3) 9, 75
4) 45, 15

6) Gametes containing chromosomes that have undergone crossing over are called...
1) modified

2) hybrid
3) crossover
4) non-crossover

«Molecular basis of inheritance» section:
Variant 1
1) What is not part of a DNA molecule?
1) uracil
2) thymine
3) phosphate
4) deoxyribose
2) A structural gene is...
1) gene directly encoding the corresponding enzyme
2) gene that activates the operon
3) gene that deactivates the operon
4) a DNA fragment recognized by RNA polymerase and providing mRNA synthesis
3) One of the DNA chains has the following nucleotide sequence: 5' C-A-C-C-G-A-C-C-A-C-T-T-G-T-A-. Build mRNA on this DNA strand.

4) Build a polypeptide chain that could be translated from the resulting mRNA.

5) Write down all the tRNAs involved in this biosynthesis. How many different types of tRNA are involved?

6) Build a complementary DNA chain.

«Molecular basis of inheritance»
Variant 2
1) The process of mRNA synthesis...
1) translation
2) transcription
3) replication
4) transduction
2) An operon is...
1) DNA fragment recognized by RNA polymerase, providing the synthesis of mRNA
2) a group of structural genes that control one metabolic process
3) non-coding region of the DNA molecule
4) DNA fragment that serves as a stop signal
3) One of the DNA chains has the following nucleotide sequence: 5'- T-A-C-C-A-A-G-T-A-G-G-A-A-T-A-. Build mRNA on this DNA strand.

4) Construct the region of the polypeptide chain encoded by this DNA.

5) Write down all the tRNAs involved in this biosynthesis. How many different types of tRNA are involved?

6) Build a complementary DNA chain.

«Molecular basis of inheritance»
Variant 3
1) The ability of a DNA molecule to reproduce itself is called...
1) transcription

2) biosynthesis
3) replication
4) translation

2) A promoter is...
1) a DNA fragment that serves as a stop signal
2) a DNA fragment recognized by RNA polymerase, providing the synthesis of mRNA
3) gene encoding the corresponding enzyme
4) non-coding DNA fragment

3) One of the DNA chains has the following nucleotide sequence: 5' C-A-C-A-G-A-A-C-C-C-T-T-T-T-T-. Build a complementary chain.

4) Build mRNA on this DNA strand.

5) Construct the region of the polypeptide chain encoded by this DNA.

6) Write down all the tRNAs involved in this biosynthesis.

«Molecular basis of inheritance»
Variant 4

1) The realization of hereditary information encoded in a DNA molecule is called...
1) biosynthesis
2) replication
3) translation
4) transcription

2) Regulator gene is...
1) gene directly encoding the corresponding enzyme
2) gene encoding a repressor protein that turns off the operon
3) DNA fragment that serves as a stop signal
4) non-coding fragment of a DNA molecule

3) One of the DNA chains has the following nucleotide sequence: 5'- T-A-C-T-G-A-T-T-T-A-T-A-T-A-C. Build mRNA on this DNA strand.

4) Construct the region of the polypeptide chain encoded by this DNA.

5) Write down all the tRNAs involved in this biosynthesis. How many different types of tRNA are involved?

6) Construct the region of the polypeptide chain encoded by this DNA.

«Molecular basis of inheritance»
Variant 5

1) A fragment of a DNA molecule that determines the sequence of amino acids in a protein molecule is called:
1) codon
2) anticodon
3) gene
4) allele

2) What function does a promoter perform in an operon?
1) provides mRNA synthesis
2) regulates the transcription process of a neighboring gene
3) serves as a stop signal for RNA synthesis
4) encodes a repressor protein

3) One of the DNA chains has the following nucleotide sequence: 5`-C-A-C-G-T-A-A-T-A-A-C-C-T-T-T-.

4) Build mRNA on this DNA strand.

5) Write down all the tRNAs involved in this biosynthesis. How many different types of tRNA are involved?

6) Construct the region of the polypeptide chain encoded by this DNA.

«Mutations» section:

Variant 1

1) A mutation that occurs when base insertions or deletions appear within a gene, which leads to a change in the meaning of several codons, is called...
   1) inversion
   2) missense mutation
   3) frameshift mutation
   4) nonsense mutation

2) An increase in the number of complete chromosome sets by 3 times is called...
   1) trisomy
   2) heteroploidy
   3) triploidy
   4) hexoploidy

3) A mutation in which the chromosome fragment containing the centromere rotates 180 degrees is called...
   1) pericentric inversion
   2) robertsonian translocation
   3) paracentric inversion
   4) tandem translocation

4) The presence in one organism of cells, tissues or organs with a different set of sex chromosomes is called:
   1) chimerism
   2) gynandromorphism
   3) mixoploidy
   4) polyploidy

5) Not biological mutagens:
   1) protozoa
   2) retrotransposons
   3) sulfonamide antibiotics
   4) plant extracts

6) Determine the mode of inheritance of anomaly in the figure:
   1) autosomal dominant
   2) autosomal recessive
   3) X-linked
   4) polygenic

«Mutations»

Variant 2

1) Gene mutations in which the amount of a biochemical product synthesized under the control of a given gene decreases, are called:
   1) hypomorphic
   2) amorphic

3) hypermorphic
4) neomorphic

2) A change in the number of chromosomes relative to the diploid set is called:
1) polyploidy
2) heteroploidy
3) aneuploidy
4) hypoploidy

3) The fusion of 2 acrocentric chromosomes at the centromere to form a meta- or submetacentric chromosome is called...
1) tandem translocation
2) reciprocal translocation
3) Robertsonian translocation
4) non-reciprocal translocation

4) An organism that has cells of different genotypes, formed as a result of 2 zygotes during embryonic development, is...
1) mosaic
2) chimera
3) gynandromorph
4) mixoploid

5) Antimutagens are substances...
1) inducing the occurrence of mutations
2) stabilizing the mutation process
3) providing genetic resistance to mutations
4) participating cell cycle controls

6) Determine the mode of inheritance of anomaly in the figure:
1) autosomal dominant
2) autosomal recessive
3) X-linked dominant
4) X-linked recessive

«Mutations»
Variant 3

1) Gene mutations in which the amount of a biochemical product synthesized under the control of a given gene increases, are called:
1) hypomorphic
2) amorphic
3) hypermorphic
4) neomorphic

2) Mutation resulting from the loss of one chromosome is called...
1) trisomy
2) monosomy
3) monoploidy
4) polyploidy

3) Chromosome formed by the presence of two terminal deletions are called...
1) isochromosome
2) ring chromosome
3) autosome
4) heterosome

4) The presence in one organism of cells with a different set of ploidies (tri-, tetra-, pentaploid, etc.) is called...
1) mosaicism
2) chimerism

3) mixoploidy
4) gynandromorphism

5) What do vitamin D, arginine, sodium selenite and gallic acid derivatives have in common?
1) they are all mutagens
2) they are all antimutagens
3) have both mutagenic and antimutagenic effects depending on the concentration
4) antimutagens, characterized by specificity of action only in relation to chromosomal aberrations.

6) Determine the mode of inheritance of anomaly in the figure:
1) autosomal dominant
2) autosomal recessive
3) X-linked dominant
4) X-linked recessive

«Mutations»

Variant 4

1) A mutation that occurs when a nucleotide is replaced within a codon, which leads to the insertion of a different amino acid at a certain place in the polypeptide chain, is called...
1) nonsense mutation
2) missense mutation
3) frameshift mutation
4) translocation

2) Quantitative changes in the chromosomal composition of cells are called:
1) gene mutation
2) chromosome aberration
3) genome mutation
4) polyploidy

3) The loss of the middle fragment of a chromosome, resulting in its shortening, is called...
1) shortage
2) inversion
3) deletion
4) translocation

4) A somatic mutation that leads to the presence of cells with different genotypes in one organism is called...
1) mosaicism
2) chimerism
3) gynandromorphism
4) polyploidy

5) Medicines (sulfonamides, nitrofurans, etc.) are classified as mutagens...
1) biological
2) chemical
3) physical
4) complex

6) Determine the mode of inheritance of anomaly in the figure:
1) autosomal recessive
2) autosomal dominant
3) multifactorial
4) X-linked

«Mutations»

Variant 5

1) The appearance of terminal codons within a gene due to the replacement of individual bases within the codons, which leads to the termination of the translation process, is called...
1) nonsense mutation

2) missense mutation
3) deletion
4) frameshift mutation

2) Mutations associated with changes in the shape, size of chromosomes, loss or addition of individual fragments are called...
1) genome mutations
2) gene mutations
3) chromosome mutations
4) point mutations

3) Mutual exchange of sections of non-homologous chromosomes is called...
1) reciprocal translocations
2) duplications
3) Robertsonian translocations
4) inversions

4) If there is no loss or gain of genetic information as a result of a chromosomal aberration, it is called...
1) balanced
2) hypermorphic
3) unbalanced
4) amorphous

5) Is not a physical mutagen
1) β-particles
2) high temperature
3) methyl radicals
4) neutrons

6) Determine the mode of inheritance of anomaly in the figure:
1) autosomal dominant
2) autosomal recessive
3) X-linked recessive
4) polygenic

Answers to test questions:

«Karyotype»

Variant/Question	1	2	3	4	5
1	3	2	1	2	2
2	2	3	3	3	3
3	4	2	3	3	3

«Meiosis»

Variant/Question	1	2	3	4	5	6
1	2	2	4	2	2	3
2	2	1	1	1	3	2

«Mitosis»

Variant/Question	1	2	3	4	5	6
1	1	3	4	1	1	3
2	1	3	2	1	2	2

«Monohybrid crosses»

Variant/Question	1	2	3	4	5	6
1	2	1	2	1	3	4

2	2	2	3	4	3	1
3	2	2	2	1	3	1
4	1	3	2	1	2	2
5	3	3	1	1	2	2

«Di- and polyhybrid crosses»

Variant/Question	1	2	3	4	5	6
1	1	1	2	2	1	4
2	1	3	2	3	3	3
3	1	4	2	2	3	4
4	4	3	1	1	2	2
5	4	2	3	1	2	4

«Linked inheritance of traits»

Variant/Question	1	2	3	4	5	6
1	1	2	3	3	3	4
2	3	1	1	2	1	2
3	1	3	2	2	4	4
4	3	4	2	2	3	4
5	4	1	3	1	2	3

«Mutations»

Variant/Question	1	2	3	4	5	6
1	3	3	1	2	3	3
2	1	2	3	2	2	2
3	3	2	2	3	3	1
4	2	3	3	1	2	4
5	1	3	1	1	3	2

«Molecular basis of inheritance»

Variant/Question	1	2
1	1	1
2	2	2
3	3	2
4	1	2
5	3	1

3.1.3. 1.2.4. List of essay topics on GPC-2 competency:

GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body.

GPC-2 ID-1 To know: ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body.

GPC-2 ID-3 To possess skills of: the knowledge of the origin of living organisms, the levels of organization of living matter, favorable and unfavorable factors affecting the body; the basis for studying environmental knowledge of the environment, the laws of the development of nature and society; skills of observation, comparative analysis, historical and experimental modeling of

the impact of anthropogenic and economic factors on living objects. with the use of digital technologies as well.

1. Application of molecular genetic technologies in animal husbandry.
2. Application of molecular genetic technologies in veterinary medicine.
3. Modern methods of genetic research in animal husbandry.
4. Modern methods of genetic research in veterinary medicine.
5. Diagnosis of a genetic disease.
6. Genetic diseases modern diagnostics for hereditary disorders in animals.
7. Application of veterinary cytogenetics in animal husbandry and veterinary medicine.
8. Application of genealogical analysis in animal husbandry and veterinary medicine.
9. Applications of CRISPR/Cas9 genome editing technology in animal husbandry and veterinary medicine.
10. Biotechnology for the livestock industry.
11. Biotechnology for the veterinary medicine.
12. Genetic engineering application in animal breeding.
13. Genetic engineering application in veterinary medicine.
14. Genetic disorders in cattle.
15. Genetic disorders in domestic pig.
16. Genetic disorders in small ruminant.
17. Genetic disorders in domestic horse.
18. Genetic disorders in pets.
19. Avian genetic disorders.
20. Multifactorial diseases in cattle.
21. Multifactorial diseases in small ruminant.
22. Multifactorial diseases in domestic pig.
23. Multifactorial diseases in domestic horse.
24. Multifactorial diseases in pets.
25. Genetic therapy in veterinary medicine.
26. Congenital disorders in cattle.
27. Congenital disorders in small ruminant.
28. Congenital disorders in domestic pig.
29. Congenital disorders in domestic horse.
30. Avian congenital disorders.
31. Congenital disorders in pets.
32. Monogenic disorders of cattle and their diagnosis.
33. Monogenic disorders of small ruminant and their diagnosis.
34. Monogenic disorders of domestic horse and their diagnosis.
35. Avian monogenic disorders and their diagnosis.
36. Моногенные заболевания с/х птицы и методы их диагностики.
37. Monogenic disorders of pets and their diagnosis.
38. Elective topic.

3.2. Standard tasks for intermediate certification

3.2.1. Exam questions

Formed competence:

GPC-2. Is able to interpret and evaluate in professional activity the influence of natural, socio-economic, genetic and economic factors on the physiological status of the animal body.
GPC-2 ID-1 To know: ecology factors of the environment, its classification and the nature of relationships with living organisms; basic ecological concepts; interspecific relations of animals and plants, terms and bio ecology laws, parasites and hosts; ecological features of some types of pathogenic microorganisms; mechanisms of influence of anthropogenic and economic factors on the animal body.
GPC-2 ID-3 To possess skills of: the knowledge of the origin of living organisms, the levels of organization of living matter, favorable and unfavorable factors affecting the body; the basis for studying environmental knowledge of the environment, the laws of the development of nature and society; skills of observation, comparative analysis, historical and experimental modeling of the impact of anthropogenic and economic factors on living objects, with the use of digital technologies as well.

EXAM QUESTIONS

1. Chromosomes: structure, morphology, and composition. Classification of chromosomes based on the position of the centromere.
2. Structure and function of telomeres. The Hayflick limit.
3. Telomere structure. Histone protein structure.
4. Levels of chromatin compaction.
5. Chromatin remodeling in eukaryotes.
6. Difference between euchromatin and heterochromatin. Types of heterochromatin. Composition of heterochromatin.
7. Mobile genetic elements in eukaryotes
8. Definition of karyotyping. Karyogram definition. Metaphase plate definition.
9. Standard karyotype of cattle.
10. Standard karyotypes of small ruminants.
11. Standard karyotype of the domestic horse.
12. Standard karyotype of the domestic pig.
13. Main features of avian karyotypes. Standard karyotype of the domestic chicken.
14. Definition, procedure and applications of karyotyping.
15. Chromosome banding techniques.
16. Systems of chromosome classification and nomenclature.
17. The FISH technique and its application in livestock genetics.
18. Cell division. Mitosis. Biological significance of mitosis.
19. Meiosis. Biological significance of meiosis.
20. Gametogenesis. Stages. Differences between spermatogenesis and oogenesis.
21. RNA: structure, types, function.
22. Non-coding RNAs.
23. Structural and functional differences between DNA and RNA.
24. Transfer RNA (t-RNA): structure and functions
25. DNA replication.

26.DNA replication enzymes.
27.DNA repair mechanisms.
28.DNA damage types.
29.Direct reversal repair in eukaryotes.
30.Base excision repair and its main steps.
31.Stages of protein Synthesis.
32.Transcription, pre-mRNA processing, alternative splicing.
33.RNA processing and its stages.
34. Post-translational modification of proteins.
35.Cell types in relation to proliferative potential.
36.Types of cell division.
37.Atypical mitosis.
38.Endoreduplication.
39.Mendel's principles of inheritance.
40.Types of genetic crosses.
41.Modes of inheritance.
42.Classification of mutations.
43.Types of chromosomal abnormalities.
44.Watson-Crick Structure of DNA.
45.DNA polymorphism.
46.Definition of chromosomal territories..
47.Kinetochore: definition and function
48.Types of dominance.
49.The role of microtubules in chromosome segregation during mitosis/meiosis.
50.Variations in sex characteristics.
51.Types of variation.
52.Gene, genome and chromosome mutations.
53.Mutagens and antimutagens.
54.Chromosomal theory of inheritance.
55.Modern concept of gene structure.
56.The structure of eukaryotic genes.
57.Non-allelic gene interactions.
58.Epistasis and complementation.
59.Pleiotropy and polygenic inheritance.
60.Modifier genes.
61.Intersexuality definition.
62.Freemartinism in cattle.
63.Hermaphroditism: definition, types and examples.
64.Genomic imprinting.
65.Klinefelter syndrome.

66.Turner syndrome.
67.Jacobs syndrome.
68.Triple X syndrome.
69.Gynandromorphism: definition and examples.
70.Definition of chimerism and mosaicism.
71.Viral genome organization.
72.Viral life cycle.
73.Bacterial genome structure.
74.Plasmid classifications and their biological significance.
75.Antibiotic resistance in bacteria.
76.Operon: definition, function and examples.
77.Gene expression during ontogenesis.
78.The driving forces of evolution.
79.Definition of population. Characteristics of popualtions.
80.Modes of speciation.
81.Definition of macroevolution.
82.Evolutionary dynamics of group formation.
83.Paths of evolution.
84.The Hardy-Weinberg equilibrium and its assumptions.
85.Parthenogenesis: definition, examples and usage.
86.Types parthenogenesis.
87.Definition of gynogenesis and androgenesis.
88.Sex inversion in fish. Sex control and manipulation in fish.
89.Polymerase chain reaction (PCR) and its use.
90.Components required for PCR. PCR basic protocols.
91.PCR primer design.
92.Types of PCR.
93.Gene mutations.
94.Genetic disorders in cattle.
95.Genetic disorders in domestic pig.
96.Genetic disorders in small ruminant.
97.Avian genetic disorders.
98.Genetic disorders in domestic horse.
99.Genetic Disorders in arabian horses
100. Causes of congenital anomalies:
101. Definition of transformation in bacteria.
102. Definition of bacterial conjugation.
103. Definition of transduction in bacteria.
104. The lytic and lysogenic cycles of bacteriophages.
105. Model organisms in genetics.
106. Genetic engineering, its techniques and applications.

107. Vectors for gene transfer.
108. Strategies for gene delivery (at least three).
109. Cloning and genetic engineering.
110. Application of cell culture technology in genetic engineering.
111. Genome-editing and its application.
112. Genome-editing technologies.
113. DNA Fingerprinting.
114. Gene therapy and genomic-based diagnostic.
115. Genomic selection.
116. Genome-wide SNP detection. DNA microarray.
117. Genomic selection for livestock breeding.
118. Gene mapping.
119. Animal genome databases.
120. Animal genetic resources.

4. METHODOLOGICAL MATERIALS DEFINING THE PROCEDURES FOR ASSESSING KNOWLEDGE, SKILLS AND ABILITIES AND WORK EXPERIENCE CHARACTERIZING THE STAGES OF COMPETENCE FORMATION

Criteria for evaluating students` knowledge during seminar:

- **Mark «excellent»** - the student clearly expresses his point of view on the issues under consideration, giving appropriate examples.
- **Mark «good»** - the student have some errors in the answer.
- **Mark «satisfactory»** - the student have gaps in knowledge of the basic educational and normative material.
- **Mark «unsatisfactory»** - the student have significant gaps in knowledge of the basic provisions of the discipline, the inability to obtain the correct solution to a specific practical problem with the help of a teacher.

Criteria for evaluating students' knowledge during the test:

Mark «excellent» the grade is given if the student answers no less than 90% of the test tasks correctly;

Mark «good» the grade is given if the student answers no less than 80% of the test tasks correctly;

Mark «satisfactory» the grade is given if the student answers no less than 70% of the test tasks correctly;

Mark «unsatisfactory» the grade is given if the student answers less than 70% of the test tasks correctly.

Criteria for evaluating students` knowledge while writing an essay.

Mark «excellent» - the problem is identified and its relevance is justified; an analysis of various points of view on the problem was made and one's own position was logically stated; conclusions are formulated, the topic is fully disclosed, the volume is maintained; formatting requirements have been met, the basic requirements for the abstract have been met.

Mark «good» - shortcomings were made. In particular, there are inaccuracies in the presentation of the material; there is no logical consistency in judgments; the volume of the essay is not

maintained; there are omissions in the design, there are significant deviations from the requirements.

Mark «satisfactory» - the topic is only partially covered; there were factual errors in the content of the essay; there are no conclusions, the topic of the essay is not disclosed.

Mark «unsatisfactory» - there is a significant misunderstanding of the problem or the essay is not presented at all.

Criteria for evaluating students` knowledge during the examination:

- **Mark «excellent»** – all types of educational work provided for in the curriculum have been completed. The student demonstrates the compliance of knowledge, skills, and abilities with the indicators given in the tables, operates with acquired knowledge, skills, and applies them in various situations of increased complexity. At the same time, inaccuracies, difficulties in analytical operations, transfer of knowledge and skills to new, non-standard situations may be allowed.
- **Mark «good» –** all types of educational work provided for in the curriculum have been completed. The student demonstrates the compliance of knowledge, skills, and abilities with the indicators given in the tables, operates with acquired knowledge, skills, and applies them in standard situations. At the same time, minor errors, inaccuracies, difficulties in analytical operations, transfer of knowledge and skills to new, non-standard situations could be made.
- **Mark «satisfactory»** – one or more types of educational work provided for in the curriculum have not been completed. The student demonstrates incomplete compliance of knowledge, skills, and abilities with the indicators given in the tables, significant errors are made, a partial lack of knowledge, skills, and skills are manifested in a number of indicators, the student experiences significant difficulties in operating with knowledge and skills when transferring them to new situations. –
- **Mark «unsatisfactory»** – the types of educational work provided for in the curriculum have not been completed. demonstrate incomplete compliance of knowledge, skills, and abilities given in the tables of indicators, significant errors are made, a lack of knowledge, skills, and skills are manifested for a large number of indicators, the student experiences significant difficulties in operating with knowledge and skills when transferring them to new situations.

6. ACCESSIBILITY AND QUALITY OF EDUCATION FOR DISABLED PEOPLE

If necessary, persons with disabilities and persons with disabilities are given additional, time to prepare an answer for the test.

When conducting the procedure for evaluating the learning outcomes of disabled people and persons with disabilities, their own technical means could be used.

The procedure for evaluating the learning outcomes of disabled people and persons with disabilities in the discipline provides for the provision of information in forms adapted to the limitations of their health and perception of information:

For people with visual impairments:	– in printed form in enlarged font; – in the form of an electronic document.
For people with hearing impairments:	– in printed form; – in the form of an electronic document.
For people with disorders of the musculoskeletal system:	– in printed form, the device; – in the form of an electronic document.

When conducting the procedure for evaluating the learning outcomes of disabled people and persons with disabilities in the discipline, it ensures that the following additional requirements are met, depending on the individual characteristics of the students:

a) instructions on the procedure for conducting the assessment procedure are provided in an accessible form (orally, in writing);

b) an accessible form of assignment of assessment tools (in printed form, in printed form in enlarged font, in the form of an electronic document, assignments are read out by the teacher);

c) an accessible form of providing answers to tasks (written on paper, a set of answers on a computer, orally).

If necessary, for students with disabilities and the disabled, the procedure for evaluating the results of training in the discipline could be carried out in several stages.

The procedure for evaluating the learning outcomes of disabled people and persons with disabilities is allowed using distant learning technologies.

24.	Inflammatory diseases incidental to postpartum. Etiology, pathogenesis, differential diagnosis, treatment and prevention. Part 2.	PC-5. To carry out plan of animal treatment, based on the stated diagnosis and animals individual character ristics, signature of necessary remedies of chemical and biological nature for the treatment, taking into account combination of its pharmacological effect on the animal body PC-5 ID-5 To know the methods of pharmacological treatment of sick animals and indications for its administration, in accordance with the guidelines, instructions, manuals, rules of diagnosis, prevention and treatment PC-5 ID-8 To know the ways of drug injections, used both for animals enteral (oral, sublingual and rectal administration) and parenteral (injections, inhalations and skin applications) methods PC-6. The selection of the variety of methods of non-drug therapy, including physiotherapy methods for the treatment of animals, carry out therapeutic, including physiotherapy procedures using special equipment in compliance with safety rules PC-6 ID-2 To be able to fix animals to ensure safety during medical procedures PC-10. Application of follow-up examinations and studies of animals to assess the effectiveness and safety of the prescribed treatment, detalisation of the animal treatment plan (if necessary) based on the results of the evaluation of the treatment effectiveness. PC-10 ID-1 To be able to evaluate the effectiveness of treatment PC-10 ID-2 To be able to use specialized information databases when choosing ways for treat animal diseases PC-15. Management of organizational, technical, zootechnical and veterinary measures for the prevention of non-contagiouse diseases in accordance with the preventive plan, analysis of the effectiveness of measures for the prevention of animal diseases for its improvement PC-15 ID-4 To be able to perform diagnostic examination of animals within the framework of medical examination for early detection of disease preclinical and clinical signs PC-15 ID-5 To know the types of measures for the prevention of non-contagious animal diseases and metabolic disorders in animals and the requirements for its implementation, in accordance with methodological guidelines, instructions, manuals, rules for the diagnosis, prevention and treatment of animals	8	2	2		6

25.	Inflammatory diseases incidental to postpartum. Etiology, pathogenesis, differential diagnosis, treatment and prevention. Part 1.	PC-5. To carry out plan of animal treatment, based on the stated diagnosis and animals individual character ristics, signature of necessary remedies of chemical and biological nature for the treatment, taking into account combination of its pharmacological effect on the animal body PC-5 ID-5 To know the methods of pharmacological treatment of sick animals and indications for its administration, in accordance with the guidelines, instructions, manuals, rules of diagnosis, prevention and treatment PC-5 ID-8 To know the ways of drug injections, used both for animals enteral (oral, sublingual and rectal administration) and parenteral (injections, inhalations and skin applications) methods PC-6. The selection of the variety of methods of non-drug therapy, including physiotherapy methods for the treatment of animals, carry out therapeutic, including physiotherapy procedures using special equipment in compliance with safety rules PC-6 ID-2 To be able to fix animals to ensure safety during medical procedures PC-10. Application of follow-up examinations and studies of animals to assess the effectiveness and safety of the prescribed treatment, detalisation of the animal treatment plan (if necessary) based on the results of the evaluation of the treatment effectiveness. PC-10 ID-1 To be able to evaluate the effectiveness of treatment PC-10 ID-2 To be able to use specialized information databases when choosing ways for treat animal diseases PC-15. Management of organizational, technical, zootechnical and veterinary measures for the prevention of non-contagiouse diseases in accordance with the preventive plan, analysis of the effectiveness of measures for the prevention of animal diseases for its improvement PC-15 ID-4 To be able to perform diagnostic examination of animals within the framework of medical examination for early detection of disease preclinical and clinical signs PC-15 ID-5 To know the types of measures for the prevention of non-contagious animal diseases and metabolic disorders in animals and the requirements for its implementation, in accordance with methodological guidelines, instructions, manuals, rules for the diagnosis, prevention and treatmentof animals	8	2	2		6

26.	Inflammatory diseases incidental to postpartum. Etiology, pathogenesis, differential diagnosis, treatment and prevention. Part 2.	PC-5. To carry out plan of animal treatment, based on the stated diagnosis and animals individual character ristics, signature of necessary remedies of chemical and biological nature for the treatment, taking into account combination of its pharmacological effect on the animal body PC-5 ID-5 To know the methods of pharmacological treatment of sick animals and indications for its administration, in accordance with the guidelines, instructions, manuals, rules of diagnosis, prevention and treatment PC-5 ID-8 To know the ways of drug injections, used both for animals enteral (oral, sublingual and rectal administration) and parenteral (injections, inhalations and skin applications) methods PC-6. The selection of the variety of methods of non-drug therapy, including physiotherapy methods for the treatment of animals, carry out therapeutic, including physiotherapy procedures using special equipment in compliance with safety rules PC-6 ID-2 To be able to fix animals to ensure safety during medical procedures PC-10. Application of follow-up examinations and studies of animals to assess the effectiveness and safety of the prescribed treatment, detalisation of the animal treatment plan (if necessary) based on the results of the evaluation of the treatment effectiveness. PC-10 ID-1 To be able to evaluate the effectiveness of treatment PC-10 ID-2 To be able to use specialized information databases when choosing ways for treat animal diseases PC-15. Management of organizational, technical, zootechnical and veterinary measures for the prevention of non-contagiouse diseases in accordance with the preventive plan, analysis of the effectiveness of measures for the prevention of animal diseases for its improvement PC-15 ID-4 To be able to perform diagnostic examination of animals within the framework of medical examination for early detection of disease preclinical and clinical signs PC-15 ID-5 To know the types of measures for the prevention of non-contagious animal diseases and metabolic disorders in animals and the requirements for its implementation, in accordance with methodological guidelines, instructions, manuals, rules for the diagnosis, prevention and treatment of animals	8	2	2		6

26.	Abortion: etiology, pathogenesis, differential diagnosis, prevention.	PC-5. To carry out plan of animal treatment, based on the stated diagnosis and animals individual character ristics, signature of necessary remedies of chemical and biological nature for the treatment, taking into account combination of its pharmacological effect on the animal body PC-5 ID-5 To know the methods of pharmacological treatment of sick animals and indications for its administration, in accordance with the guidelines, instructions, manuals, rules of diagnosis, prevention and treatment PC-5 ID-8 To know the ways of drug injections, used both for animals enteral (oral, sublingual and rectal administration) and parenteral (injections, inhalations and skin applications) methods PC-6.The selection of the variety of methods of non-drug therapy, including physiotherapy methods for the treatment of animals, carry out therapeutic, including physiotherapy procedures using special equipment in compliance with safety rules PC-6 ID-2 To be able to fix animals to ensure safety during medical procedures PC-10. Application of follow-up examinations and studies of animals to assess the effectiveness and safety of the prescribed treatment, detalisation of the animal treatment plan (if necessary) based on the results of the evaluation of the treatment effectiveness. PC-10 ID-1 To be able to evaluate the effectiveness of treatment PC-10 ID-2 To be able to use specialized information databases when choosing ways for treat animal diseases PC-15. Management of organizational, technical, zootechnical and veterinary measures for the prevention of non-contagiouse diseases in accordance with the preventive plan, analysis of the effectiveness of measures for the prevention of animal diseases for its improvement PC-15 ID-4 To be able to perform diagnostic examination of animals within the framework of medical examination for early detection of disease preclinical and clinical signs PC-15 ID-5 To know the types of measures for the prevention of non-contagious animal diseases and metabolic disorders in animals and the requirements for its implementation, in accordance with methodological guidelines, instructions, manuals, rules for the diagnosis, prevention and treatment of animals	8	2	2		6

27.	Mammary gland diseases. Etiology, pathogenesis, differential diagnosis, treatment and prevention.	PC-5. To carry out plan of animal treatment, based on the stated diagnosis and animals individual character ristics, signature of necessary remedies of chemical and biological nature for the treatment, taking into account combination of its pharmacological effect on the animal body PC-5 ID-5 To know the methods of pharmacological treatment of sick animals and indications for its administration, in accordance with the guidelines, instructions, manuals, rules of diagnosis, prevention and treatment PC-5 ID-8 To know the ways of drug injections, used both for animals enteral (oral, sublingual and rectal administration) and parenteral (injections, inhalations and skin applications) methods PC-6. The selection of the variety of methods of non-drug therapy, including physiotherapy methods for the treatment of animals, carry out therapeutic, including physiotherapy procedures using special equipment in compliance with safety rules PC-6 ID-2 To be able to fix animals to ensure safety during medical procedures PC-10. Application of follow-up examinations and studies of animals to assess the effectiveness and safety of the prescribed treatment, detalisation of the animal treatment plan (if necessary) based on the results of the evaluation of the treatment effectiveness. PC-10 ID-1 To be able to evaluate the effectiveness of treatment PC-10 ID-2 To be able to use specialized information databases when choosing ways for treat animal diseases PC-15. Management of organizational, technical, zootechnical and veterinary measures for the prevention of non-contagiouse diseases in accordance with the preventive plan, analysis of the effectiveness of measures for the prevention of animal diseases for its improvement PC-15 ID-4 To be able to perform diagnostic examination of animals within the framework of medical examination for early detection of disease preclinical and clinical signs PC-15 ID-5 To know the types of measures for the prevention of non-contagious animal diseases and metabolic disorders in animals and the requirements for its implementation, in accordance with methodological guidelines, instructions, manuals, rules for the diagnosis, prevention and treatment of animals	8	2	2		6

28.	Mastitis. Part 1.	PC-5. To carry out plan of animal treatment, based on the stated diagnosis and animals individual character ristics, signature of necessary remedies of chemical and biological nature for the treatment, taking into account combination of its pharmacological effect on the animal body PC-5 ID-5 To know the methods of pharmacological treatment of sick animals and indications for its administration, in accordance with the guidelines, instructions, manuals, rules of diagnosis, prevention and treatment PC-5 ID-8 To know the ways of drug injections, used both for animals enteral (oral, sublingual and rectal administration) and parenteral (injections, inhalations and skin applications) methods PC-6. The selection of the variety of methods of non-drug therapy, including physiotherapy methods for the treatment of animals, carry out therapeutic, including physiotherapy procedures using special equipment in compliance with safety rules PC-6 ID-2 To be able to fix animals to ensure safety during medical procedures PC-10. Application of follow-up examinations and studies of animals to assess the effectiveness and safety of the prescribed treatment, detalisation of the animal treatment plan (if necessary) based on the results of the evaluation of the treatment effectiveness. PC-10 ID-1 To be able to evaluate the effectiveness of treatment PC-10 ID-2 To be able to use specialized information databases when choosing ways for treat animal diseases PC-15. Management of organizational, technical, zootechnical and veterinary measures for the prevention of non-contagiouse diseases in accordance with the preventive plan, analysis of the effectiveness of measures for the prevention of animal diseases for its improvement PC-15 ID-4 To be able to perform diagnostic examination of animals within the framework of medical examination for early detection of disease preclinical and clinical signs PC-15 ID-5 To know the types of measures for the prevention of non-contagious animal diseases and metabolic disorders in animals and the requirements for its implementation, in accordance with methodological guidelines, instructions, manuals, rules for the diagnosis, prevention and treatment of animals	8	2	2		6

29.	Mastitis. Part 2.	PC-5. To carry out plan of animal treatment, based on the stated diagnosis and animals individual character ristics, signature of necessary remedies of chemical and biological nature for the treatment, taking into account combination of its pharmacological effect on the animal body PC-5 ID-5 To know the methods of pharmacological treatment of sick animals and indications for its administration, in accordance with the guidelines, instructions, manuals, rules of diagnosis, prevention and treatment PC-5 ID-8 To know the ways of drug injections, used both for animals enteral (oral, sublingual and rectal administration) and parenteral (injections, inhalations and skin applications) methods PC-6. The selection of the variety of methods of non-drug therapy, including physiotherapy methods for the treatment of animals, carry out therapeutic, including physiotherapy procedures using special equipment in compliance with safety rules PC-6 ID-2 To be able to fix animals to ensure safety during medical procedures PC-10. Application of follow-up examinations and studies of animals to assess the effectiveness and safety of the prescribed treatment, detalisation of the animal treatment plan (if necessary) based on the results of the evaluation of the treatment effectiveness. PC-10 ID-1 To be able to evaluate the effectiveness of treatment PC-10 ID-2 To be able to use specialized information databases when choosing ways for treat animal diseases PC-15. Management of organizational, technical, zootechnical and veterinary measures for the prevention of non-contagiouse diseases in accordance with the preventive plan, analysis of the effectiveness of measures for the prevention of animal diseases for its improvement PC-15 ID-4 To be able to perform diagnostic examination of animals within the framework of medical examination for early detection of disease preclinical and clinical signs PC-15 ID-5 To know the types of measures for the prevention of non-contagious animal diseases and metabolic disorders in animals and the requirements for its implementation, in accordance with methodological guidelines, instructions, manuals, rules for the diagnosis, prevention and treatment of animals	8	2	2		7

30.	Ovaries diseases. Etiology, pathogenesis, differential diagnosis, treatment and prevention.	PC-5. To carry out plan of animal treatment, based on the stated diagnosis and animals individual character ristics, signature of necessary remedies of chemical and biological nature for the treatment, taking into account combination of its pharmacological effect on the animal body PC-5 ID-5 To know the methods of pharmacological treatment of sick animals and indications for its administration, in accordance with the guidelines, instructions, manuals, rules of diagnosis, prevention and treatment PC-5 ID-8 To know the ways of drug injections, used both for animals enteral (oral, sublingual and rectal administration) and parenteral (injections, inhalations and skin applications) methods PC-6. The selection of the variety of methods of non-drug therapy, including physiotherapy methods for the treatment of animals, carry out therapeutic, including physiotherapy procedures using special equipment in compliance with safety rules PC-6 ID-2 To be able to fix animals to ensure safety during medical procedures PC-10. Application of follow-up examinations and studies of animals to assess the effectiveness and safety of the prescribed treatment, detalisation of the animal treatment plan (if necessary) based on the results of the evaluation of the treatment effectiveness. PC-10 ID-1 To be able to evaluate the effectiveness of treatment PC-10 ID-2 To be able to use specialized information databases when choosing ways for treat animal diseases PC-15. Management of organizational, technical, zootechnical and veterinary measures for the prevention of non-contagiouse diseases in accordance with the preventive plan, analysis of the effectiveness of measures for the prevention of animal diseases for its improvement PC-15 ID-4 To be able to perform diagnostic examination of animals within the framework of medical examination for early detection of disease preclinical and clinical signs PC-15 ID-5 To know the types of measures for the prevention of non-contagious animal diseases and metabolic disorders in animals and the requirements for its implementation, in accordance with methodological guidelines, instructions, manuals, rules for the diagnosis, prevention and treatment of animals	8	2	2		7

31.	Infertility. Classification. Principles of differential diagnosis. Veterinary control of herd fertility.	PC-5. To carry out plan of animal treatment, based on the stated diagnosis and animals individual character ristics, signature of necessary remedies of chemical and biological nature for the treatment, taking into account combination of its pharmacological effect on the animal body PC-5 ID-5 To know the methods of pharmacological treatment of sick animals and indications for its administration, in accordance with the guidelines, instructions, manuals, rules of diagnosis, prevention and treatment PC-5 ID-8 To know the ways of drug injections, used both for animals enteral (oral, sublingual and rectal administration) and parenteral (injections, inhalations and skin applications) methods PC-6. The selection of the variety of methods of non-drug therapy, including physiotherapy methods for the treatment of animals, carry out therapeutic, including physiotherapy procedures using special equipment in compliance with safety rules PC-6 ID-2 To be able to fix animals to ensure safety during medical procedures PC-10. Application of follow-up examinations and studies of animals to assess the effectiveness and safety of the prescribed treatment, detalisation of the animal treatment plan (if necessary) based on the results of the evaluation of the treatment effectiveness. PC-10 ID-1 To be able to evaluate the effectiveness of treatment PC-10 ID-2 To be able to use specialized information databases when choosing ways for treat animal diseases PC-15. Management of organizational, technical, zootechnical and veterinary measures for the prevention of non-contagiouse diseases in accordance with the preventive plan, analysis of the effectiveness of measures for the prevention of animal diseases for its improvement PC-15 ID-4 To be able to perform diagnostic examination of animals within the framework of medical examination for early detection of disease preclinical and clinical signs PC-15 ID-5 To know the types of measures for the prevention of non-contagious animal diseases and metabolic disorders in animals and the requirements for its implementation, in accordance with methodological guidelines, instructions, manuals, rules for the diagnosis, prevention and treatment of animals	8	2	2		7

32.	General principles of rectal examination. Biotechnological methods for improvement of reproduction in herd. Embryo transfer in cattle breeding.	PC-5. To carry out plan of animal treatment, based on the stated diagnosis and animals individual character ristics, signature of necessary remedies of chemical and biological nature for the treatment, taking into account combination of its pharmacological effect on the animal body PC-5 ID-5 To know the methods of pharmacological treatment of sick animals and indications for its administration, in accordance with the guidelines, instructions, manuals, rules of diagnosis, prevention and treatment PC-5 ID-8 To know the ways of drug injections, used both for animals enteral (oral, sublingual and rectal administration) and parenteral (injections, inhalations and skin applications) methods PC-6. The selection of the variety of methods of non-drug therapy, including physiotherapy methods for the treatment of animals, carry out therapeutic, including physiotherapy procedures using special equipment in compliance with safety rules PC-6 ID-2 To be able to fix animals to ensure safety during medical procedures PC-10. Application of follow-up examinations and studies of animals to assess the effectiveness and safety of the prescribed treatment, detalisation of the animal treatment plan (if necessary) based on the results of the evaluation of the treatment effectiveness. PC-10 ID-1 To be able to evaluate the effectiveness of treatment PC-10 ID-2 To be able to use specialized information databases when choosing ways for treat animal diseases PC-15. Management of organizational, technical, zootechnical and veterinary measures for the prevention of non-contagiouse diseases in accordance with the preventive plan, analysis of the effectiveness of measures for the prevention of animal diseases for its improvement PC-15 ID-4 To be able to perform diagnostic examination of animals within the framework of medical examination for early detection of disease preclinical and clinical signs PC-15 ID-5 To know the types of measures for the prevention of non-contagious animal diseases and metabolic disorders in animals and the requirements for its implementation, in accordance with methodological guidelines, instructions, manuals, rules for the diagnosis, prevention and treatment of animals	8	2	2	4	7
TOTAL FOR 8 SEMESTER				**32**	**38**	**10**	**100**
TOTAL FOR COURSE:				**66**	**64**	**18**	**176**

6. THE LIST OF EDUCATIONAL AND METHODOLOGICAL SUPPORT FOR STUDENTS' SELF WORK

6.1. Guidelines for individual work

1. Dyul'ger, G. P. Akusherstvo, ginekologiya i biotekhnika razmnozheniya koshek : uchebnoe posobie / G. P. Dyul'ger, E. S. Sedleckaya. — 2-e izd., ispr. i dop. — Sankt-Peterburg : Lan', 2021. — 168 s. (data obrashcheniya: 21.06.2022).
2. Studencov A.P., SHipilov V.S., Nikitin V.YA., Petrov A.M., Dyul'ger G.P., Hramcov V.V., Preobrazhenskij O.N. Akusherstvo, ginekologiya i biotekhnika reprodukcii zhivotnyh. – SPb, Lan', 2019 – 548 s. https://e.lanbook.com/book/111907 (data obrashcheniya 21.06.2022).
3. Polyancev N.I., Mihajlova L.B. Akusherstvo, ginekologiya i biotekhnika razmnozheniya zhivotnyh. – SPB, Lan', 2019 – 448 s. https://e.lanbook.com/book/112061 (data obrashcheniya 21.06.2022).

6.2. Literature for individual work

1.Allen, V.E. Polnyj kurs akusherstva i ginekologii sobak. Per. s anglijskogo. / V.E. Allen // – M., Akvarium, 2002 – 448 s.
2. Dyul'ger, G.P. Akusherstvo, ginekologiya i biotekhnika razmnozheniya koshek / G.P. Dyul'ger // – M., Kolos, 2004 – 101 s.
3. Karpov, V.A. Akusherstvo i ginekologiya melkih domashnih zhivotnyh / V.A. Karpov // – M., Rosagropromizdat, 1990 – 288 s.

7. THE LIST OF BASIC AND ADDITIONAL LITERATURE NECESSARY FOR THE EDUCATION

a) basic literature:

1.Allen, V.E. Polnyj kurs akusherstva i ginekologii sobak. Per. s anglijskogo. / V.E. Allen // – M., Akvarium, 2002 – 448 s.
2. Dyul'ger, G.P. Akusherstvo, ginekologiya i biotekhnika razmnozheniya koshek / G.P. Dyul'ger // – M., Kolos, 2004 – 101 s.
3. Karpov, V.A. Akusherstvo i ginekologiya melkih domashnih zhivotnyh / V.A. Karpov // – M., Rosagropromizdat, 1990 – 288 s.

b) additional literature:

1. Polyancev N.I. Praktikum po akusherstvu, ginekologii i biotekhnike razmnozheniya zhivotnyh. – SPB, Lan', 2016 – 272 s. https://e.lanbook.com/book/71726 (data obrashcheniya 21.06.2022)
2. Dyul'ger G.P., Hramcov V.V., Sibileva YU.G., Kemeshov ZH.O. Lekarstvennye sredstva, primenyaemye v veterinarnom akusherstve, ginekologii, andrologii i biotekhnike razmnozheniya zhivotnyh. – SPB, Lan', 2016 – 272 s. https://e.lanbook.com/book/75510 (data obrashcheniya 21.06.2022)
3. Sorokoletova V.M., Gorb N.N. Akusherstvo i ginekologiya. Bolezni organov reproduktivnoj sistemy sel'skohozyajstvennyh zhivotnyh invazionnoj i infekcionnoj prirody. – SPB, Lan', 2013 – 84 s. https://e.lanbook.com/book/44523 (data obrashcheniya 21.06.2022)

8. THE LIST OF RESOURCES OF THE INFORMATION AND TELECOMMUNICATION NETWORK "INTERNET" NECESSARY FOR EDUCATION OF THE DISCIPLINE

To prepare for practical classes and perform independent work, students can use the following Internet resources:

1. https :// meduniver . com – Medical information site.

Electronic library systems:

1. EBS "SPBGU VM"
2. EBS "Publishing house "Lan"
3. EBS "Student Consultant"
4. Legal reference system "ConsultantPlus"
5. University information system "RUSSIA"
6. Full text database POLPRED.COM
7. Scientific electronic library ELIBRARY.RU
8. Russian Scientific Network
9. Electronic library system IQlib
10. Web of Science International Science Citation Index Database
11. Full-text interdisciplinary database of agricultural and environmental sciences ProQuest AGRICULTURAL AND ENVIRONMENTAL SCIENCE DATABASE
12. Electronic books from the publishing house "Prospekt Nauki" http://prospektnauki.ru/ebooks
13. Collection "Agriculture. Veterinary" publishing house "Kvadro" http://www.iprbookshop.ru/586.html

9. METHODOLOGICAL GUIDELINES FOR STUDENTS ON EDUCATION OF THE DISCIPLINE

Methodological recommendations for students are a set of recommendations and explanations that allow the student to optimally organize the process of studying this discipline. The content of methodological recommendations, as a rule, may include:

- Tips for planning and organizing the time needed to study the discipline. Description of the sequence of student actions, or "scenario for studying the discipline."

The morning time is the most fruitful for academic work (from 8-14 o'clock), followed by the afternoon (from 16-19 o'clock) and evening time (from 20-24 o'clock). The most difficult material is recommended to be studied at the beginning of each time interval after rest. After 1.5 hours of work, a break (10-15 minutes) is required; after 4 hours of work, the break should be 1 hour. Part of the scientific organization of labor is mastering the technique of mental work. Normally, a student should devote about 10 hours a day to studying (6 hours at the university, 4 hours at home).

- Recommendations for preparing for practical classes

Practical (seminar) classes constitute an important part of students' professional training. The main goal of conducting practical (seminar) classes is to develop analytical, creative thinking in students by acquiring practical skills. Practical classes are also conducted with the aim of deepening and consolidating the knowledge gained at lectures and in the process of independent work on regulatory documents, educational and scientific literature. When preparing for a practical lesson for students, it is necessary to study or repeat theoretical material on a given topic.

When preparing for a practical lesson, the student is recommended to adhere to the following algorithm;

1) get acquainted with the plan of the upcoming lesson;

2) study the literature sources that were recommended and familiarize yourself with the introductory comments to the relevant sections.

Methodological instructions for practical (seminar) classes in the discipline, along with the work program and schedule of the educational process, refer to methodological documents that determine the level of organization and quality of the educational process.

The content of practical (seminar) classes is recorded in the working curriculum of the disciplines in the sections "List of topics for practical (seminar) classes."

The most important component of any form of practical training is assignments . The basis of the assignment is an example, which is analyzed from the perspective of the theory developed in the lecture. As a rule, the main attention is paid to the formation of specific skills and abilities, which determines the content of students' activities - problem solving, laboratory work, clarification of the categories and concepts of science, which are a prerequisite for correct thinking and speech.

Practical (seminar) classes perform the following tasks:

- stimulate regular study of recommended literature, as well as attentive attention to the lecture course;
- consolidate the knowledge gained in the process of lecture training and independent work on literature;
- expand the scope of professionally significant knowledge, skills and abilities;
- allow you to check the correctness of previously acquired knowledge;
- instill skills of independent thinking and oral presentation;
- promote free use of terminology;
- provide the teacher with the opportunity to systematically monitor the level of students' independent work.

Methodological instructions for practical (seminar) classes in the discipline should be focused on modern business conditions, current regulatory documents, advanced technologies, on the latest achievements of science, technology and practice, on modern ideas about certain phenomena and the reality being studied.

• Recommendations for working with literature.

Working with literature is an important stage of a student's independent work in mastering a subject, contributing not only to consolidation of knowledge, but also to broadening his horizons, mental abilities, memory, ability to think, present and confirm his hypotheses and ideas. In addition, research skills necessary for future professional activities are developed.

When starting to study literature on a topic, it is necessary to make notes, extracts, and notes. It is imperative to take notes on the works of theorists, which allow one to comprehend the theoretical basis of the study. For the rest, you can limit yourself to extracts from studied sources. All extracts and quotations must have an exact "return address" (author, title of work, year of publication, page, etc.). It is advisable to write an abbreviated name of the question to which the extract or quotation relates. In addition, it is necessary to learn how to immediately compile a card index of specialized literature and publications of sources, both proposed by the teacher and identified independently, as well as refer to bibliographic reference books, chronicles of journal articles, book chronicles, and abstract journals. In this case, publications of sources (articles, book titles, etc.) should be written on separate cards, which must be filled out in accordance with the rules of bibliographic description (surname, initials of the author, title of work. Place of publication, publisher, year of publication, number of pages, and for journals articles – journal name, year of publication, page numbers). On each card, it is advisable to record the thought of the author of the book or a fact from this book on only one specific issue. If the work, even in the same paragraph or phrase, contains further judgments or facts on another issue, then they should be written out on a separate card. The presentation should be concise,

accurate, without subjective assessments. On the back of the card you can make your own notes about this book or article, its contents, structure, what sources it was written on, etc.

• Explanations about working with test materials for the course, recommendations for completing homework.

Testing allows you to determine whether the actual behavior of a program corresponds to the expected behavior by performing a specially selected set of tests. A test is the fulfillment of certain conditions and actions necessary to verify the operation of the function being tested or its part. Students are required to select the correct option for each question in the discipline.

11. EDUCATIONAL WORK

Within the framework of the discipline, educational work aims to cultivate a modern scientific worldview and fundamental values, foster spiritual, moral, civil, and patriotic virtues, nurture aesthetic and ethical understanding, promote a tolerant mindset in society, and instill in students the recognition of work as a fundamental necessity, the highest value, and the primary path to success in life. Additionally, it seeks to underscore the social significance of students' future professions.

11. THE LIST OF INFORMATION TECHNOLOGIES USED IN THE IMPLEMENTATION OF THE EDUCATIONAL PROCESS

11.1. Information technologies

The educational process in the discipline provides for the use of information technologies:

✓ conducting practical classes using multimedia;

✓ interactive technologies (conducting dialogues, collective discussion of various approaches to solving a particular educational and professional problem);

✓ interaction with students via email;

✓ joint work in the Electronic Information and Educational Environment of St. Petersburg State University of Veterinary Medicine: https://spbguvm.ru/academy/eios

11.2. Software

List of licensed and freely distributed software, including domestically produced ones

№	Technical and computer programs recommended by sections and topics of the program	License
1	MS PowerPoint	67580828
2	LibreOffice	free software
3	OS Alt Education	AAO.0022.00
4	ABIS "MARK-SQL"	02102014155
5	MS Windows 10	67580828
6	System Consult Plus	503/КЛ
7	Android OS	free software

12. THE MATERIAL AND TECHNICAL BASE NECESSARY FOR THE IMPLEMENTATION OF THE DISCIPLINE EDUCATIONAL PROCESS.

Name of the discipline	Name of rooms for classes or independent work	Equipment of rooms for classes or independent work
Obstetrics and gynecology	215 (Saint Petersburg, st. Chernigovskaya, 5, 196084) Classroom for conducting seminars, consultations and	*Specialized furniture:* desks, chairs, stools, teaching board. *Visual aids and educational materials:* Wet preparations of

	course assessment	obstetric and gynecological pathologies of all types of animals, corpses of small animals and limbs of large ungulates with dissected muscles, vessels and nerves, fixed preparations of internal organs of all types of animals by system, skeletons of all domestic animals; demonstration tables, diagrams and x-rays on all topics of lectures, laboratory and seminars; instruments for obtaining sperm and artificial insemination of animals, obstetric instruments (knives, tweezers, scalpels, scissors of all types, instruments for fetotomy and obstetrics), models; posters on the sections of obstetrics and gynecology, *Technical teaching aids:* multimedia projector, screen, laptop; microscopes.
	221 (Saint Petersburg, st. Chernigovskaya, 5, 196084) Classroom for conducting seminars, consultations and course assessment	*Specialized furniture:* desks, chairs, stools, teaching board. *Visual aids and educational materials:* Wet preparations of obstetric and gynecological pathologies of all types of animals, corpses of small animals and limbs of large ungulates with dissected muscles, vessels and nerves, fixed preparations of internal organs of all types of animals by system, skeletons of all domestic animals; demonstration tables, diagrams and x-rays on all topics of lectures, laboratory and seminars; instruments for obtaining sperm and artificial insemination of animals, obstetric instruments (knives, tweezers, scalpels, scissors of all types, instruments for fetotomy and obstetrics), models; posters on the sections of obstetrics and gynecology, *Technical teaching aids:*

		multimedia screen, microscopes.
	133 (Saint Petersburg, st. Chernigovskaya, 5, 196084) Classroom for conducting seminars, consultations and course assessment	*Specialized furniture:* tables, chairs. *Technical teaching aids:* multimedia projector, screen, laptop, restraint frames for cattle.
	132 (Saint Petersburg, st. Chernigovskaya, 5, 196084) Laboratory for conducting seminars, consultations and course assessment	*Specialized furniture:* tables with special cover. *Technical teaching aids:* laboratory glassware, specialized laboratory equipment, microscopes, stereoscopic microscope, Dewar flask, chemicals for sperm research refrigerator, instruments for obtaining sperm and artificial insemination of animals, obstetric instruments (knives, tweezers, scalpels, scissors of all types, instruments for fetotomy and obstetrics) multimedia projector, screen, laptop, *Visual aids and educational materials:* cryopreserved sperm.
	206 Big reading room (Saint Petersburg, st. Chernigovskaya, 5, 196084) Room for independent work	*Specialized furniture:* tables, chairs *Technical teaching aids:* computers with an Internet connection and access to the electronic information and electronic educational environment
	214 Small reading room (Saint Petersburg, st. Chernigovskaya, 5, 196084) Room for independent work	*Specialized furniture:* tables, chairs *Technical teaching aids:* computers with an Internet connection and access to the electronic information and electronic educational environment
	324 Information technology department (Saint Petersburg, st. Chernigovskaya, 5, 196084) Room for storage and preventive maintenance of educational equipment	*Specialized furniture:* tables, chairs, special equipment, materials and spare parts for preventive maintenance of educational equipment.

	Box №3 Carpentry workshop (Saint Petersburg, st. Chernigovskaya, 5, 196084) Room for storage and preventive maintenance of educational equipment	*Specialized furniture:* tables, chairs, special equipment, materials for preventive maintenance of specialized furniture.

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