Національний технічний університет України
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
імені ІГОРЯ СІКОРСЬКОГО»

Department of Industrial Biotechnology

Integration and differentiation of modern scientific knowledge in biotechnology

Work program of the discipline (Syllabus)

Details of the discipline

Level of higher education	***Third (educational and scientific)***
Branch of knowledge	***16 "Chemical and Bioengineering"***
Specialty	***162 - Biotechnology and bioengineering***
Educational program	***Biotechnology***
Discipline status	***Normative***
Form of study	***part-time***
Year of preparation, semester	***1st year, autumn semester***
The scope of discipline	***4 ECTS***
Semester control / control measures	***Exam/MCW, thematic work***
Lesson's schedule	***Lectures 6 hour; practical classes 2 hour according to the schedule***
Language of instruction	***Ukrainian, english***
Information about course leader / teachers	***Lecturer: Doctor of Engineering Science, Ass. prof. Todosiichuk Tetiana*** ***Doctor of Physics and Mathematics, Professor Hryhoriy Lytvynov*** ***Lytgs3@gmail.com*** ***Practical: Doctor of Physical and Mathematicsl, professor Litvinov Grigory Sergeevich***
Course placement	http://prombiotech.kpi.ua/en/student/english-doctor-philosophy/english-integration-and-differentiation-of-modern-scientific-knowledge-in-biotechnology/ https://do.ipo.kpi.ua/course/index.php?categoryid=24; ECampus

Curriculum of the discipline

1. Description of the discipline, its purpose, subject of study and learning outcomes

Qualitative fundamental training of doctors of philosophy in biotechnology is provided by mastering the disciplines of philosophical direction, which focuses on the prerequisites and processes, logical and methodological principles of formation and development of modern scientific and practical knowledge of system-forming and special disciplines of biotechnology.

The origin, initiation and development of the scientific foundation of biotechnology is provided by the processes and algorithms of integration and further accelerated progress of a new field of knowledge with its differentiated subject, methods and results, which were not obtained in the original sciences.

It should be emphasized that such processes are generally decisive in the development of all modern new scientific disciplines and fields of knowledge and therefore mastering the material of this discipline is the foundation for understanding and predicting strategies for the emergence and development of any modern field of knowledge. a reliable basis for predicting trends and effective applications of acquired knowledge and skills in the practice of doctors of philosophy.

The purpose of the discipline is to form in future doctors of philosophy in biotechnology a system of competencies, skills and activities for analysis and forecasting of ways of biotechnology development based on the application of knowledge about algorithms for differentiation of industrial biotechnologies and their integration with other related science-intensive industries. progress of directional design tools and optimal implementation for the design and creation of new biotechnological products.

The subject of the discipline is the knowledge and mastering of the laws of the emergence and further development of integrated theoretical and experimental principles, methods and approaches of natural and engineering sciences for their applications in biotechnological scientific and industrial activities.

Program learning outcomes

As a result of studying the discipline "Integration and differentiation of modern scientific knowledge in biotechnology", higher education students acquire the following general competencies and program results:

General competencies (GC):

- Ability to search, process and analyze information from various sources.
- Ability to abstract thinking, analysis and synthesis.
- Ability to work in an international scientific context.
- Ability to generate new ideas (creativity), to conduct research at the appropriate level.
- The ability to form a systematic scientific worldview.

Professional competencies (FC)

- Ability to perform original research, achieve scientific results that create new knowledge in the field of biotechnology and bioengineering and related interdisciplinary areas and can be published in leading scientific journals in biotechnology and related fields.
- Ability to use modern information technologies, databases and other electronic resources, specialized software in scientific and educational activities. Ability to use modern information technologies, databases and other electronic resources, specialized software in scientific and educational activities.

Program learning outcomes (PLO):

- Knowledge of general philosophical concepts, understanding of the role of science in the development of society.
- Knowledge of modern methods of research, organization and planning of the experiment, the practice of publishing scientific results.
- Develop and implement scientific and / or innovative engineering projects that provide an opportunity to rethink existing and create new holistic knowledge and / or professional practice and solve significant scientific and technological problems of biotechnology in compliance with academic ethics and social, economic, environmental and legal aspects.
- Plan and perform experimental and / or theoretical research in biotechnology and related interdisciplinary areas using modern specialized knowledge and instrumental methods, critically analyze the results of their own research and the results of other researchers in the context of the whole complex of modern knowledge on the problem.

Students must also demonstrate the following learning outcomes after completing the course

Knowledge:

- the necessary attributes of modern sciences in general and their specifics in biotechnology as an innovative activity;
- algorithms and mechanisms of formation of biotechnology on the basis of integration of structural sciences, its further independent development up to differentiation of special biotechnologies for the maximum performance of social and economic functions;
- structural and logical scheme of biotechnology as a science, industrial and educational specialty;
- specifics of application of physico-chemical and biological methods of research and transformations of biotechnological products for rationalization of production;

Skills:

- use of approaches, algorithms and methods of logical and methodological analysis of processes and results of integration and differentiation of sciences and practical activities for the development of biotechnology;

- self-development of personal information base and its use in postgraduate activities in relevant positions;
- analysis of achievements and directions of development taking into account economic efficiency along with the need for public control of possible threats to the use and distribution of biotechnological products;
- application of the acquired knowledge to the analysis of the processes of differentiation and integration in the process of conducting research, discussion of the results and formation of the content of the dissertation.

Prerequisites and post-requisites of the discipline (place in the structural and logical scheme of education according to the relevant educational program)

In the structural and logical scheme of the program of training doctors of philosophy in the specialty 162 Biotechnology and Bioengineering the discipline is based on previously studied disciplines of the master's program, in particular, a cycle of social sciences and obtained philosophically oriented and specifically scientific knowledge disciplines: "Biochemistry", "Microbiology and virology", Biophysics "," Genetics "," General Biotechnology ", etc. The discipline corresponds to the relevant sections of the disciplines of the program of training of doctors of philosophy "Philosophical principles of scientific activity", "Problematic issues of ecobiotechnology and bioenergy", "Modern achievements of bioengineering and bioinformatics"..

1. The content of the discipline

Section 1. Logical and methodological principles of integration and differentiation of modern scientific knowledge

1.1. Scientific and customary knowledge. Dialectics and systematics are immanent features of scientific knowledge. Science as a result of scientific knowledge: logic and tools of development. Novelty and didactics of science, general and special in scientific and educational knowledge.

1.2. The structure of science: the ideal and material foundations.

1.3. Object, subject, methods of science and research. Subject - a specific attribute of a particular science. General scientific and specifically scientific methods.

1.4. Classification of scientific knowledge: natural and humanities, basic and applied sciences.

1.5. Theoretical and experimental sciences. Specificity and classification of engineering sciences.

1.6. Logics of the emergence of new sciences and scientific disciplines: differentiation and development, integration by object and methods, transfer of approaches and stereotypes.

1.7. Socio-economic demand is the main stimulus for the development of science. Innovation is a tool for integrating scientific and economic activities.

1.8. Science and technology. Systems of modern technologies.

Section 2. Integration and differentiation of scientific knowledge in biotechnology

2.1. The unity of logical and historical in the emergence and development of biotechnology.

2.2. Biotechnology in the system of economics and many modern engineering technologies.

2.3. Definitions of biotechnology as a branch of science and economic activity.

2.4. Integral nature of scientific and instrumental-methodical foundations of biotechnology as a branch of science. Genomics, proteomics and bioinformatics are the defining components of biotechnology.

2.5. Definition of the subject of biotechnology, biotechnological research.

2.6. Problems of specificity of application and development in biotechnology of methods of structural sciences.

2.7. Structural and functional analysis of economic, managerial and engineering components of biotechnological production. Information component of biotechnological production.

2.8.Problems of training a biotechnological engineer as a system analyst in ensuring and improving the activities of biotechnological production.

4. Training materials and resources

Suggested Reading

Basic

1. Bhatia, Saurabh & Goli, Divakar. (2018). History, scope and development of biotechnology. https://iopscience.iop.org/chapter/978-0-7503-1299-8/bk978-0-7503-1299-8ch1.pdf

2. Tartaruga, Iván G. Peyré & Cazarotto, Rosmari Terezinha & Martins, Clitia Helena Backx & Fukui, Ana, 2016. "Innovation and public understanding of science: possibility of new indicators for the analysis of public attitudes to science, technology and innovation," MPRA Paper 76262, University Library of Munich, Germany.
https://www.oecd.org/sti/117%20-%20Paper_Ivan%20G%20P%20T%20et%20al.pdf

3. BIOTECHNOLOGY – Vol. II - Methods in Biotechnology - David A. Mitchell, Adriana Contin
https://www.eolss.net/sample-chapters/C17/E6-58-02-00.pdf

4. American Association for the Advancement of Science, Project 2061. Science for All Americans Summary. Washington, DC: American Association for the Advancement of Science, 1995.
http://www.project2061.org/publications/sfaa/online/sfaatoc.htm

5. Zika, Eleni & Papatryfon, Ilias & Wolf, Oliver & Gómez-Barbero, Manuel & Stein, Alexander & Bock, Anne-Katrin. (2007). Consequences, Opportunities and Challenges of Modern Biotechnology for Europe. 145. https://ec.europa.eu/jrc/sites/jrcsh/files/jrc_reference_report_200704_biotech.pdf

Additional

1. Bioinformatics Introduction to genomics and proteomics http://bioinformaticsinstitute.ru/sites/default/files/genomics_and_proteomics_i.pdf

2.Srinibas Kumar Important techniques of biotechnology: 3 Techniques
https://www.biologydiscussion.com/biotechnology/techniques-biotechnology/important-techniques-of-biotechnology-3-techniques/15683

3. Differentiation and integration Nature biotechnology 2001, vol.19.- N7.-P.597-608
https://www.nature.com/articles/nbt0701_597.pdf

4. How Science and Technology Are for Society? 59p.
https://www.mext.go.jp/component/english/__icsFiles/afieldfile/2011/03/03/1302821_002.pdf

5. What is biotechnology? 2020 https://www.iberdrola.com/innovation/what-is-biotechnology

Information resources

The main electronic information resources on the subject are:
http://www.scribd.com

crcpress.com
bookre.
biofile.com
cbio.ru
studopedia.net
mirknig.com
Ebooks.pdfs.org
Ebookee.org
Springer.com
Onlinelibrary.wiley.com
Iubmb.org
Eloss.net
Ecobio.nau.edu.ua
Bur.com.ua
Info-library.com.ua
www.bookre.org
strf.ru
pandia.ru
allrefs.net

Educational content

5.Methods of mastering the discipline (educational component)

Lectures

The discipline is based on the skills and knowledge acquired by students in the study of previous disciplines of the curriculum. Since this discipline summarizes the knowledge acquired by students on all biotechnological compounds that act either as molecular machines in biosynthesis, or is the purpose of production of biotechnological products, when mastering the material special attention should be paid to repetition and detailing knowledge of chemistry, physics, biology. Models of structures and functions of biotechnological objects are an important part of the discipline. Lectures provide a presentation of the most general and problematic to learn sections of the content, which are best presented in sources 1, 2, 5, in the list of basic literature.

No.	*The title of the lecture topic and a list of key issues*
1	***Lecture 1. Specifics of scientific knowledge. Definitions, attributes, structure of science.*** 1.1. Scientific and customary knowledge. 1.2. Dialectics and systematics are immanent features of scientific knowledge. 1.3. Science as a result of scientific knowledge: logic and tools of development. Suggested Readings [Basic: 1]
2	***Lecture 2. Integration and differentiation of scientific knowledge in biotechnology.*** 4.1. The unity of logical and historical in the emergence and development of biotechnology. 4.2. Biotechnology in the system of economics and many modern engineering technologies. 4.3. Biotechnology is a branch of science and economic activity. Suggested Readings [Basic: 2,5, Additional:3]
3	***Lecture 3. Material and ideal series of biotechnological science and production*** 9.1. Theory and experiment in biotechnological science. 9.2. Engineering component of applied biotechnology. 9.3.Professional and socio-ethical components of training a biotechnologist as a systems analyst. Suggested Readings [Basic: 3-5, Additional: 2]

Practical training

The main objectives of the series of seminars on the subject "Integration and differentiation of modern scientific knowledge in biotechnology" are:

• acquisition, consolidation and expansion of skills, knowledge and experience gained in the course of lectures and independent work in the discipline;

• independent in-depth study of program issues that are of increased interest to the graduate student in view of the topic of his dissertation and / or the content of the proposed post-defense activities;

• development of skills and experience in presenting a public report, answering questions and conducting a discussion on a selected topic using multimedia tools;

• determination and assessment of the level and quality of acquired competencies as a result of lectures on the discipline.

• substantiation and choice of the topic of the personal report, elaboration of the literature and writing of the synopsis of the text and the plan of the report, oral presentation of the report with multimedia support, answers to the questions of the seminar participants;

• participation in discussions on the reports of other participants of the seminars by formulating questions and supplementary speeches on the topics of the reports.

Work on a seminar on the subject involves:

1) preparation of materials on a pre-selected topic from a set of topics proposed by the teacher;

2) oral report of the graduate student-speaker lasting up to 20 minutes;

3) answers of the speaker to the questions of the teacher and graduate students - participants of the lesson;

4) additional speeches-additions of the participants of the lesson on the main report;

5) discussion with the participation of the speaker, graduate students and teacher in the process of discussing the topic.

The main teaching methods include strategies of active individual and collective learning, which are determined by the following learning technologies:

1) methods of problem-based learning (problem-based presentation, part-search (heuristic conversation) and research method);

2) personality-oriented (developing) technologies based on active forms and methods of teaching, in particular "brainstorming" in small groups, discussion on the topic of practical classes, and student reports;

3) information and communication technologies that provide problem-solving nature of the learning process and activation of independent work of students (electronic presentations for lectures, use of audio, video support of classes, development and application of creative tasks based on computer and multimedia tools , supplementing traditional training sessions by means of interaction based on network communication capabilities).

No.	Name of the topic of the lesson
1	Seminar 1. Differentiation and integration as ubiquitous processes in scientific and industrial activities. Suggested Readings *[1,2, 4, 7]*
	Modular test

6. Independent work of a graduate student

The graduate student's independent work in the discipline includes preparation for classroom classes (24 hours), modular control (4 hours), preparation for the exam (30 hours) and independent study of certain topics, the list of which is given below (62 hours).

No.	*Names of topics and questions submitted for self-study and references to educational literature*	*Number of hours of independent work*
1	The structure of science: the ideal and material foundations. 1. Attributes of science: object, subject, methods of science and scientific research. 2. Subject - a specific attribute of a particular science.	*8*

	3. General scientific and specifically scientific methods. Suggested Readings [Basic:1,2 Additional:4,]	
2	The logic of the emergence of new knowledge. Algorithms for differentiation and integration of scientific knowledge. 1. Logics of emergence of new sciences and scientific disciplines: differentiation and development, integration on object and methods, transfer of approaches and stereotypes. 2. Socio-economic demand is the main stimulus for the development of science. Innovation is a tool for integrating scientific and economic activities. 3. Science and technology. Systems of modern technologies. Suggested Readings [Basic: 2, Additional: 2,5]	*14*
3	Structural and functional analysis of biotechnology as a megacomplex system 1. Definition of the subject of biotechnology, biotechnological research. 2. Problems of specificity of application and development in biotechnology of methods of structural sciences. 3. Structural and functional biotechnological production. Suggested Readings [Basic: 3, Additional: 2]	*20*
4	The main components of biotechnology as an integrated system 1. Integral nature of scientific and instrumental-methodical foundations of biotechnology as a branch of science. 2. Genomics, proteomics, metabolomics and bioinformatics - the main components of biotechnology. 3. Components of biotechnological production. Suggested Readings [Basic: 5, Additional:1]	*6*
5	Biotechnology objects in the hierarchy of living things as a whole 1. Levels of organization of biological matter. 2. Integration of knowledge at hierarchical levels of living organization 3. Specifics of biotechnological objects Suggested Readings [Basic: 1,2,4, Additional: 5]	*4*
6	Integration and differentiation of methods of basic and applied sciences in biotechnology 1. Adaptation and modification of physico - chemical preparative methods for their application in biotechnology. 2. Requirements for the adequacy of analytical methods borrowed from physicochemistry to biotechnological research and production. 3. Application of general scientific and specific scientific approaches and methods in the process of interpretation and implementation of research results in practice. Suggested Readings [Basic: 3, Additional: 3]	*6*
7	Problems of training a biotechnological engineer as a systems analyst in ensuring and improving the activities of biotechnological production. Formulate requirements for professional and socio-psychological activities of a PhD biotechnologist. *References: additional literature and information sources from the list*	*4*

Policy and control

7. Course policy (educational component)

Deadline and recompilation policy: *Works that are submitted in violation of deadlines without good reason are evaluated at a lower grade. Rearrangement of topics (modules) occurs for good reasons.*

The policy and principles of academic integrity *are defined in Section 3 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute». Details: https://kpi.ua/code. The use of additional sources of information when assessing knowledge is prohibited (including mobile devices).*

Mobile devices may only be used during online testing and calculations.Norms of ethical behavior: *Norms of ethical behavior of students and employees are defined in Section 2 of the Code of Honor of the National Technical University of Ukraine "Kyiv Polytechnic Institute named after Igor Sikorsky". Details: https://kpi.ua/code.*

***Attendance policy**: Attendance at lectures, seminars, as well as absence from them, is not assessed. But graduate students must attend all lectures and seminars, as they teach theoretical material and develop the skills necessary for the formation of competencies defined by the educational and scientific program of Biotechnology. Also required is a report with a presentation of the thematic work. The activity of the graduate student is determined by his participation in the discussion of reports of other graduate students and additions to the content of the discussion. The assessment system is focused on obtaining points for student activity, as well as performing tasks that are able to develop practical skills and abilities. For objective reasons (eg illness, employment, international internship, etc.), training can take place online in consultation with the course leader.*

8. Types of control and rating system for evaluation of learning outcomes

***Current control**: Evaluation of the success of mastering the discipline by the graduate student is carried out according to the rating system on the basis of current control during classroom classes. The total amount of points for the semester work is 50 points, which consists of 25 points for the report, 5 points for active participation in seminars, 20 points for the modular test.*

The maximum number of points for a report at a seminar is 25 points.

The highest grade (25 points) is given to the graduate student if the thematic work is performed: (1) 25-30 pages, which (2) covers 10-15 primary sources, including the last 2-3 years, and 3) contains analytical and review material illustrated with tables and figures and correct answers to the questions of the seminar participants.

A work that does not meet at least one of these criteria receives **20** points.

The MCR, in which two of the specified conditions are not fulfilled, is estimated at 15 points.

The student receives 10 points for the MCR, which only partially meets these criteria.

The maximum amount of points for the module test for graduate students is **25** points.

24-25 points - the correct answers to all questions

20-23 points - the correct answers, but there are no accuracy or minor errors

15-19 points - no answer to one of the questions, or significant errors in the answers to the question.

0-14 - work is not credited

***Calendar control**: is conducted twice a semester as a monitoring of the current state of compliance with the requirements of the syllabus.*

***Semester control**: examination. The total amount of points on the exam is 50 points.*

Conditions of admission to semester control:

1) enrollment of the seminar report;

2) performance of modular control work on a positive assessment;

starting (pre-examination) rating Rst> 25.

The exam ticket consists of 4 questions. The correct answer to each of the exam questions is estimated by the same amount of points – **12.5.**

The maximum amount of points on the examination control – **50 points** is obtained by the graduate student who answered all the questions of the examination ticket correctly.

The correct complete answer to the question - 12 - 12.5 points

Minor errors in the answer 10 - 11 points

Significant errors in answering the question - 7.5 - 9 points

The answer is not credited - 0-7 points.

The overall rating of the student in the discipline is calculated by the formula:

$$Rd = Rst + Rexam = 100$$

The transfer of the rating to the traditional system is carried out according to the table.

Table of correspondence of rating points to grades on a university scale.

Rd = Rst + Rexam	**ECTS**	**Traditional**
95-100	A	Excellent
85-94	B	Very good
75-84	C	Good
65-74	D	Satisfactorily
60-64	E	Enough

Rd <60	Fx	Unsatisfactorily
Rst <30 or other conditions of admission to the exam are not met	F	Not allowed

9. Additional information to the discipline

Topics of modular control work are given in Appendix 1.

Additional oral questions to the examination tickets of the discipline "Problems of integration and differentiation of modern scientific knowledge" taking into account the specifics of the dissertation planned by the graduate student are given in Appendix 2

Test tasks for self-control and preparation for the exam in the discipline "Integration and differentiation of modern scientific knowledge in biotechnology" are given in Appendix 3.

Work program of the discipline (syllabus):

Compiled Doctor of Physical and Mathematics, professor Litvinov Grigory Sergeevich

Approved Department of Industrial Biotechnology (протокол № 13 від 22.06.20)

Agreed Methodical commission of the faculty (протокол № 10 від 26.06.20)

Appendix 1.

Approximate topics of modular control work in the discipline "Differentiation and integration of modern scientific knowledge in biotechnology"

1. Logical and methodological principles of integration and differentiation of scientific knowledge.
2. Features of integration and differentiation of scientific natural knowledge.
3. Processes of integration and differentiation of knowledge in biotechnology.
4. Integration and differentiation of scientific knowledge in the content of education in biotechnology.
5. Integration and differentiation of scientific knowledge in specific research on the topic of dissertation.
6. Integration and modifications of physicochemical methods in biotechnology.
7. Integration of biotechnology with microbiology.
8. Integration of biotechnology with clinical and molecular virology.
9. Integration of biotechnology with general and molecular cytology
10. Integration of biotechnology with molecular biology.
11. Integration of biotechnology with biochemistry.
12. Integration of biotechnology with genetics.
13. Features of integration and differentiation of scientific knowledge in agrobiotechnology
14. Integration of biotechnology with medicine.
15. Integration and differentiation of biotechnological and ecological knowledge.
16. Integration and differentiation of scientific knowledge in biotechnology of engineering enzymology.
17. Integration and differentiation of scientific knowledge in specific research on the topic of dissertation.

Appendix 2.

Additional oral questions to the examination tickets of the discipline "Problems of integration and differentiation of modern scientific knowledge" taking into account the specifics of the dissertation planned by the graduate student

1.Definition of the object and subject of the dissertation
2. Manifestation of integration of methods of sciences in materials of dissertation research
3. Definition of a theme and development of researches on a theme of dissertation work as an example of differentiation of scientific knowledge
4. Novelty and priority of the received results - necessary attributes of dissertation researches
5. Substantiation of relevance of dissertation researches on the basis of the analysis of contradictions of the reached and necessary scientific and social and economic levels of development
6. Differentiation of achievement of the purpose of researches on separate purposes and tasks.
7. Integration of work results in the general conclusion and its differentiation into conclusions from different sections of work.
8. Generalized captions to figures and tables as a manifestation of knowledge integration.
9. The use of graphs for integrated-differentiated representation of research results.
10. The use of integration and differentiation of knowledge in technological and hardware schemes for the production of biotechnological substances.
11. Analysis and synthesis in cognition as a basis for differentiation and integration of knowledge.

12. Analytical and synthetic cognition - a dialectical, systemic process.
13. Manifestations of unity and contradiction in the processes of integration and differentiation of scientific knowledge.

Appendix 3.

Test tasks for self-control and preparation for the exam in the discipline "Integration and differentiation of modern scientific knowledge in biotechnology"

Question 1. Differentiation of scientific knowledge is:

1) The division of scientific information into sections by object and methods of cognition
2) Selection of a certain field of knowledge from their general set
3) Selection and independent development of the subject of a particular field of knowledge
4) Selection of a certain set of knowledge from the general system on the object, methods and results of cognition

Question 2. The components of the first order structure of modern science as a social institution are:

1) Subject, object, methods, results
2) Subject, purpose, methods, tools, results
3) Material and ideal principles
4) Material and ideal phenomena

Question 3. The specifics of a particular science is determined:

1) The object and methods of cognition
2) Methods and results of cognition
3) Significance for economic development
4) The subject and methods of cognition

Question 4. Biotechnology as a scientific discipline is the result of integration:

1) Biochemistry, genetics, cytology
2) Proteomics, genomics, bioinformatics
3) Molecular biology, genetics, microbiology
4) Microbiology and chemical technology

Question 5. The subject of proteomics:

1) Proteins and their supramolecular homogeneous and heterogeneous complexes
2) Proteins, lipo-, nucleo-, liponucleo-, phospholipo-, protein complexes
3. Regularities of construction and functioning of proteins and their complexes
4) There is no correct answer.

Question 6. Differentiation and integration of scientific knowledge:

1) Opposites of the dialectical process
2) Antagonistic opposites
3) Mutually exclusive processes
4) Complementary opposites

Question 7. The task in the dissertation is the result:

1) Integration of goals
2) Differentiation of the process of achieving the goal of work
3) Differentiation and integration of the purpose and subject of research
4) Definition of methods and stages of research

Question 8. The relevance of research is determined by:
1) The expected economic effect
2) Scientific novelty and significance of the results
3) The modernity of the methods used
4) Scientific and practical application of the results

Question 9. The formulation of the relevance of research is achieved as a result of analysis:
1) Subject, methods, object of research
2) Achieved level of research and necessary for scientific and socio-economic progress
3) Contradictions between the achieved and the required level of development of science and practice
4) Answers 1 and 3 are correct.

Question 10. The scientific level of the dissertation is not determined:
1) The modernity of the methods used
2) The novelty of the results
3) The number of patenting results
4) Confirmation of the results of works by other authors

Question 11. Application of physicochemical methods in biological research:
1) Does not require modifications during in vivo studies
2) Always requires their modifications taking into account the specifics of the subject of research
3) Requires their modifications during in vivo studies
4) Does not always require modifications

Question 12. The concept of systematic and dialectical knowledge in modern science:
1) Not related
2) Identical
3) Not identical
4) Related

Question 13. The subject of genomics:
1) Patterns of gene structure and functions
2) Patterns of construction and functioning of DNA
3) Patterns of existence and development of genetic material
4) Physico-chemical characteristics of the implementation of genetic information

Question 14. Objects of proteomics, genomics and bioinformatics:
1) Identical
2) Differentiated
3) May coincide and differ
4) There is no correct answer

Question 15. The subject of bioinformatics:

1) Patterns of existence and functioning of genetic information
2) Patterns of existence and realization of genetic information
3) Databases on genes and their protein products
4) Regularities of general and special in genetic information and protein phenotypes of differentiated binomials

Question 16. Integration and differentiation of knowledge is not a specification of categories:

1) General and partial
2) General and special
3) Synthesis and analysis
4) System and element

Question 17. Biotechnology is:

1) Field of scientific and practical activities
2) Applied science
3) Integral branch of natural and socio-economic knowledge
4) The result of the integration of biology and technology

Question 18. Which of the following activities is not a branch of industrial biotechnology:

1) Production of proteins
2) Production of vaccines and sera
3) Genetic engineering
4) Agrobiotechnology

Question 19. The subsystem of biotechnology of which order is the production of essential amino acids:

1) Another
2) The third
3) The first
4) The fourth

Question 20. The definition of the concept through genus and species trait is an example:

1) Differentiation of knowledge
2) Integration of knowledge
3) Differentiation and integration of knowledge
4) There is no correct answer

Questions 21. Fundamentals of biotechnology as a science:

1) Microbiology, cytology, genetics
2) Biology, biochemistry, genetics
3) Biophysics, biology, biochemistry
4) Biology, physics and chemistry

Questions 22. Which of the following are not general scientific methods of natural sciences:

1) Statistical and mathematical
2) Physico-chemical and biological
3) Analytical and synthetic

4) Classification

Question 23. Which of the following methods is specifically scientific:

1) Simulation
2) Comparative classification
3) Structural and functional
4) Direct observation

Question 24. Innovation is:

1) Scientific result used in production
2) New scientific knowledge, integrated with previous ones
3) Commercialized scientific achievement
4) Scientific result protected by a patent

Question 25. Engineering (technical) sciences do not necessarily provide:

1) Integration with the economy
2) Contribution to the basic sciences
3) Environmental assessment of the results
4) Using research results to meet human needs

Question 26. The subject of biotechnology as a field of scientific knowledge are patterns:

1) Design and manufacture of products to meet human needs using microorganisms
2) Obtaining biologically active substances based on cell synthesis
3) Substantiation, design and production of products to meet human needs using molecular cellular mechanisms
4) Construction and operation of product production technologies to meet human needs in conditions of limited resources

Question 27. The theoretical foundation of biotechnology is formed by:

1) Physics, chemistry, biology
2) Basic natural and exact sciences
3) Physics, chemistry, biology, mathematics, geology
4) Physics, chemistry, biology, geology, mathematics, microbiology.

Question 28. Agrobiotechnology is the result of:

1) Integration of biotechnological and agrotechnological knowledge by object
2) Differentiation of biotechnology by object
3) Integrations and differentiations by object
4) Differentiation of agricultural technology

Question 29. Agrobiotechnology is:

1) Biotechnology using plant cells
2) Biotechnology based on cellular mechanisms of plants
3) Biotechnology based on molecular cellular mechanisms of plants
4) Biotechnology using molecular cellular mechanisms of plant and animal cells.

Question 30. The integration of scientific knowledge occurs by:

1) Object, methods, results, subject

2) Object, results, methods, application
3) Subject, results, general scientific methods
4) By socio-economic significance

Question 31. Biotechnology borrows knowledge from genetics:
1) Protein production programs
2) Methods of creating and using protein production programs
3) Patterns of construction and development of genetic programs
4) Methods and technologies for creating and multiplying genetic material

Question 32. The fundamental reason for the differentiation of biotechnology into subsystems:
1) Diversity of economic needs
2) Versatility of products of cell-molecular synthesis
3) Diversity of human needs
4) Answers 2 and 3 are correct

Question 33. According to socio-economic functions, biotechnology is differentiated into:
1) Medical, food, feed, plant, cellular, molecular, biosensor, chemical-pharmaceutical, agricultural, animal, cosmetic, industrial, ecological
2) Medical, food, microbiological, vegetable
3) Food, medical, veterinary, microorganism, industrial, biosensor
4) Food, medical, biosensory

Question 34. The information subsystem of biotechnology does not include:
1) Scientific knowledge, laws, resolutions of the Verkhovna Rada and the Cabinet of Ministers,
2) Regulations, instructions, statutes, orders, instructions,
3) Modes, instructions, decisions of collective management bodies, protocols, working logs, reports, analytical investigations
4) There is no correct answer

Question 35. The structure of biotechnological production does not include:
1) Logistics
2) Operational and technological support
3) Marketing support
4) 1 and 2

Question 36. Subsystems of biotechnological enterprise activity:
1) Administrative and managerial
2) Personnel, production and technological
3) Financial
4) Distribution, marketing, advertising and information

Question 37. The subject of ecobiotechnology:
1) Patterns of conservation and reproduction of oos on the basis of biotechnological knowledge and production
2) Regularities of application of biotechnologies to the solution of problems of environmental pollution
3) Patterns of stabilization of ecological balance in conditions of limited natural resources
4) Regularities of ecologically safe integration and differentiation of human activity and the natural environment

Question 38. The method is:

1) An ordered set of operations, techniques, tools, actions of the subject of activity
2) The law of motion of the object of study
3) The way to achieve the goal
4) A set of descriptions of means of activity and recommendations for their use

Question 39. Dissertation research is:
1) The form of differentiation of new knowledge of the chosen direction from the parallel existing ones
2) A form of integration of new knowledge into previously functioning
3) Form of development of differentiated direction of knowledge
4) The set of answers 1 and 2 is correct

Question 40. Hardware scheme for the production of biotechnological products:
1) Completely identical to the hardware scheme of chemical production
2) May differ from the hardware scheme of chemical production by the product unit
3) Differs in equipment for cleaning the final product
4) Differs in the equipment for packing and packing

Question 41. Technological and hardware schemes in the dissertation are intended for:
1) Selection of the obtained results in the system of previously known
2) Illustrations and confirmation of conclusions from the obtained results
3) Integration of the obtained results into previously known
4) The set of answers 1 and 3 is correct.

Question 42. Function of names of tables, captions of figures, graphs:
1) Statement of content
2) Statement of results
3) Analytical and generalizing in terms of content
4) Generalizing and concluding

Question 43. Biotechnology is the result of the integration of knowledge:
1) Engineering and biological
2) Technological and socio-economic
3) Physico-chemical and engineering
4) Chemical-technological and biological

Question 44. The subject of science and the subject of scientific research are:
1) As general and special
2) As a whole and part
3) As a system and subsystem
4) All answers are correct

Question 45. At what stage of the technological scheme are necessarily integrated biological and technological knowledge:
1) Preparation of raw materials
2) Fermentation
3) Cleaning
4) Quality control

Question 46. What is the first-order subsystem of the method of activity:
1) Reception
2) Operation
3) Methodology
4) Action

Question 47. The methodology is:

1) Differentiated set of methods of a particular activity
2) The doctrine of the validity and application of methods of activity
3) The doctrine of the structure and applicability of methods of activity
4) Integration of descriptions of a set of methods and rules of their application

Question 48. In the biotechnological system, the greatest uncertainty is provided by:

1) Limited accuracy of technical subsystems
2) Participation of the operator in the operation and management
3) The use of organic products
4) Non-standard raw materials

Question 49. Application of physicochemical methods in biotechnology:

1) Requires modifications taking into account the specifics of the object
2) Does not require modifications taking into account the specifics of the object
3) Requires special preparation of the object
4) Requires the adequacy of the method to the differentiated characteristics of the object

Question 50. For the success of a biotechnologist the most important component of personality:

1) Professional and valeological
2) Value-oriented and communicative
3) Cognitive-educational and cognitive-scientific
4) All of the above are equally important

Question 51. Which of the following properties of science is not expressed socially:

1) Didactics
2) Novelty
3) Innovation
4) Fundamentality

Question 52. What is the main factor of poorly structured biotechnology system:

1) Devices and equipment
2) Organic producers
3) Operators and specialists
4) Competitive environment

Question 53. Which of the subsystems of protein biotechnology contains the least uncertainty:

1) Subsystem of fixed assets
2) Subsystem of logistics and product distribution
3) Labor capital
4) Financial capital (working capital and securities)

Question 54. Which component gives the greatest uncertainty to the production subsystem of biotechnology:

1) Devices and equipment
2) Raw materials and organic producers
3) Staff
4) Energy supply

Question 55. Protein engineering refers to:

1) Natural systems of unorganized complexity
2) Industrial systems of organized complexity
3) Socio-economic systems of organized simplicity
4) Socio-economic systems of organized complexity

Question 56. Bioproducers of proteins are:

1) Unstructured systems of unorganized complexity
2) Natural systems of organized simplicity
3) Natural systems of organized complexity
4) Natural poorly structured systems

Question 57. Protein molecules are natural systems:

1) Organized simplicity
2) Organized complexity
3) Unorganized complexity
4) Natural weak structure

Question 58. Biotechnological enzymes in comparison with cells-converters of raw materials have advantages:

1) More structured systems
2) Less structured systems
3) Less uncertain systems
4) Answers 1 and 3 are correct

Question 59. Under cell conditions, genomic DNA relative to protein metameric complexes are:

1) More complex systems
2) Less complex systems
3) More structured systems
4) Less structured systems

Question 60. Of the physical environmental factors, the most important for the uncertainty of protein-engineering industries are:

1) The Earth's magnetic field
2) Penetrating cosmic radiation
3) Natural background of penetrating electromagnetic radiation
4) Electromagnetic radiation of industrial plants

Question 61. How in the production subsystem of biotechnological activity should increase the structure and certainty:

1) Improving product quality control
2) Reducing the level of staff participation in the production process
3) Improving the automation of production processes
4) Answers 2 and 3 are correct

Question 62. For the development of the subsystem of biotechnological innovations is crucial:

1) Certainty
2) Perfection of the experimental base

3) Poor structure
4) Factor of free will of the researcher

Question 63. What type of systems is biotechnology?
1) Indefinite complexity
2) Organized simplicity
3) Unorganized complexity
4) Organized complexity

Question 64. Biotechnology is:
1) Structured system
2) Uncertain socio-economic system
3) Weakly structured system
4) Unstructured system

Question 65. The complexity of the organization of biotechnology refers to systems:
1) Complex indefinite
2) Supercomplicated defined
3) Extremely structured
4) Super-supercomplex poorly structured

Question 66. Uncertainty in the biotechnology system is caused by:
1) The presence of operators as elements of the system
2) Insufficient qualification of specialists-operators
3) Imperfection of technical devices
4) Imperfection of the used technologies

Question 67. According to the definition of the European Association of Biotechnology:
1) Patterns of existence and development of a system of knowledge about the essence of the processes of production of important human substances using biological processes
2) Regularities of production of substances necessary for humans based on the use of bioproducts on an industrial scale
3) Laws of existence and development of properties and production of substances necessary for the person on the basis of application of microorganisms-bioproducers on an industrial scale
4) The set of answers 1 and 3 is correct

Question 68. The system of properties of biotechnological objects includes characteristics:
1) Physico-chemical
2) Socio-economic
3) Biological
4) All these subsystems

Question 69. What properties are most stimulating for the production of molecular biological products:
1) The biological nature of production
2) Cheapness of raw materials, operational processes, ease of reproduction of producing organisms

3) Efficiency of changes of assortment and achievement of a variety of production due to universality of the organization and functioning of cellular and molecular processes of production
4) Properties 2 and 3