Appendix to the work program

Federal State Budgetary Educational Institution of Higher Education
"Privolzhsky Research Medical University"
Ministry of Health of the Russian Federation

BANK OF ASSESSMENT TOOLS FOR DISCIPLINE

BIOTECHNOLOGY

Training program (specialty): 33.05.01 PHARMACY

Department: Pharmaceutical Chemistry and Pharmacognosy

Mode of study: full-time

Nizhniy Novgorod
2022

1. Bank of assessment tools for the current monitoring of academic performance, mid-term assessment of students in the discipline "Biotechnology"

This Bank of Assessment Tools (BAT) for the discipline " **Biotechnology** " is an integral appendix to the working program of the discipline " **Biotechnology** ". All the details of the approval submitted in the WPD for this discipline apply to this BAT.

2. List of assessment tools

The following assessment tools are used to determine the quality of mastering the academic material by students in the discipline "**Biotechnology"**

No	Assessment tool	Brief description of the assessment tool	Presentation of the assessment tool in the BAT
1	Test	A system of standardized tasks that allows you to automate the procedure of measuring the level of knowledge and skills of a student	Bank of test tasks
2	Colloquium	A tool of controlling the mastering of study materials of a topic, section or sections of a discipline, organized as a class in the form of an interview between a teacher and students.	Questions on topics/sections of the discipline
3	Interview	A tool of control organized as a special conversation between the teacher and the student on topics related to the discipline being studied, and designed to clarify the amount of knowledge of the student on a specific section, topic, problem, etc.	Questions on topics/sections of the discipline
4	Situational tasks	A method of control that allows you to assess the criticality of thinking and the degree of the material comprehension, the ability to apply theoretical knowledge in practice.	List of tasks

3. A list of competencies indicating the stages of their formation in the process of mastering the educational program and the types of evaluation tools

Code and wording of the competence*	Stage of competence formation	Controlled sections of the discipline	Evaluation tools

UC-1. ability to carry out critical analysis of problem situations based on a systematic approach, develop an action strategy	Entry, Current, Mid-term	Section 1. Theoretical foundations of biotechnological production Section 2. Basic processes and apparatuses of biotechnological production Section 3. Fundamentals of technology for culturing cells and tissues of multicellular organisms. Cellular engineering. Section 4. Selection and mutagenesis. Fundamentals of genetic engineering. Genetically engineered medicinal products Section 5. Medical and pharmaceutical biotechnology.	Tests, control questions, situational tasks, individual survey
UC-2 ability to manage a project at all stages of its life cycle	Entry, Current, Mid-term	Section 1. Theoretical foundations of biotechnological production Section 2. Basic processes and apparatuses of biotechnological production Section 3. Fundamentals of technology for culturing cells and tissues of multicellular organisms. Cellular engineering. Section 4. Selection and mutagenesis. Fundamentals of genetic engineering. Genetically engineered medicinal products Section 5. Medical and pharmaceutical biotechnology.	Tests, control questions, situational tasks, individual survey
GPC-1. ability to use basic biological, physico-chemical, chemical, mathematical methods for the development, research and examination of medicinal products, manufacturing of medicinal products	Entry, Current, Mid-term	Section 1. Theoretical foundations of biotechnological production Section 2. Basic processes and apparatuses of biotechnological production Section 3. Fundamentals of technology for culturing cells and tissues of multicellular organisms. Cellular engineering. Section 4. Selection and mutagenesis. Fundamentals of genetic engineering. Genetically engineered medicinal products Section 5. Medical and pharmaceutical biotechnology.	Tests, control questions, situational tasks, individual survey
GPC-3 ability to carry out professional activities taking into account specific economic, environmental, social factors within the framework of the system of regulatory regulation of the sphere of circulation of medicines	Entry, Current, Mid-term	Section 1. Theoretical foundations of biotechnological production Section 2. Basic processes and apparatuses of biotechnological production Section 3. Fundamentals of technology for culturing cells and tissues of multicellular organisms. Cellular	Tests, control questions, situational tasks, individual survey

		engineering. Section 4. Selection and mutagenesis. Fundamentals of genetic engineering. Genetically engineered medicinal products Section 5. Medical and pharmaceutical biotechnology.	
GPC-6 ability understand the principles of modern information technologies and use them to solve professional tasks	Entry, Current, Mid-term	Section 1. Theoretical foundations of biotechnological production Section 2. Basic processes and apparatuses of biotechnological production Section 3. Fundamentals of technology for culturing cells and tissues of multicellular organisms. Cellular engineering. Section 4. Selection and mutagenesis. Fundamentals of genetic engineering. Genetically engineered medicinal products Section 5. Medical and pharmaceutical biotechnology.	Tests, control questions, situational tasks, individual survey
PC-7 implementation of operations related to the technological process in the production of medicines, and their control	Entry, Current, Mid-term	Section 1. Theoretical foundations of biotechnological production Section 2. Basic processes and apparatuses of biotechnological production Section 3. Fundamentals of technology for culturing cells and tissues of multicellular organisms. Cellular engineering. Section 4. Selection and mutagenesis. Fundamentals of genetic engineering. Genetically engineered medicinal products Section 5. Medical and pharmaceutical biotechnology.	Tests, control questions, situational tasks, individual survey

4. Content of assessment tools for input and current control Input / current control is carried out by the teacher of the discipline when conducting classes in the form of: tests, control questions, situational tasks, individual survey, abstract.

4.1. Tasks for assessing the competencies of UC-1, UC -2, GPC-1, GPC -3, GPC -6, PC-7 are presented on the PIMU Educational Portal:

https://sdo.pimunn.net/course/view.php?id=1830

4.2. Questions for colloquiums and interviews *(*UC-1, UC -2, GPC-1, GPC -3, GPC -6, PC-7*)* are presented on the PIMU Educational Portal:

https://sdo.pimunn.net/course/view.php?id=1830

4.3. Tasks (assessment tools) submitted for the exam (UC-1, UC -2, GPC-1, GPC -3, GPC -6, PC-7*)* are presented on the PIMU Educational portal:

https://sdo.pimunn.net/course/view.php?id=1830

5. The content of the assessment tools of mid-term assessment

Mid-term assessment is carried out in the form of a credit

The fund of assessment tools for conducting current monitoring and intermediate certification of students in this discipline is presented on the PIMU Educational portal:

https://sdo.pimunn.net/course/view.php?id=1830

5.1 The list of control tasks and other materials necessary for the assessment of knowledge, skills and work experience

5.1.1. Questions for *the Biotechnology credit*

1. Biotechnology as a science. Development history. Connection with the fundamental sciences of the twentieth century. The main sections of biotechnology.
2. The main variants of the continuous cultivation process (ideal displacement and mixing modes, turbidostatic and chemostatic).
3. Optimization of cloned gene expression through strong regulated promoters or their integration into the host cell chromosome
4. The main objects of biotechnology. Features of the structure and metabolism. Features of cultivation.
5. Cultures of animal and plant cells and tissues. Problems and peculiarities of cultivation. Advantages of cell and tissue culture.
6. Main carriers and methods of immobilization of biocatalysts.
7. Basic hardware requirements. Classification of fermenters by energy input method.
8. Basic processes of cellular metabolism. Catabolitic and anabolic processes and their interrelation. The concept of primary and secondary metabolites. Mechanisms of regulation of metabolic processes.
9. Anaerobic processes and technologies based on them. Glycolysis. Alcohol and glycerol fermentation. Fermentation in an alkaline environment.
10. Metabolic overload. Adverse consequences and ways to overcome its aversion.
11. Aerobic processes. Processes with complete and incomplete oxidation. The Krebs cycle. Glyoxylate cycle. β-oxidation of fatty acids.
12. Selection of producer microorganisms. Methods and approaches in breeding. The main types of mutagens and their mechanism of action. Directed mutagenesis.
13. Polymer biomaterials. Basic requirements for polymer biomaterials. Main application areas. "Smart biopolymers".
14. Technology for obtaining Krebs cycle intermediate acids (citric and ketoglutaric).
15. Diagnostic systems (enzyme immunoassay, DNA diagnostics).
16. Cellular engineering. Protoplasts. Protoplast fusion. Hybridomas.
17. Design features of equipment for the use of immobilized biocatalysts
18. Basic approaches to antibiotic biosynthesis. The role of predecessors. Mutational biosynthesis. Semi-synthetic antibiotics.
19. Preparation and biotransformation of steroids, alkaloids, and other medicinal substances. Main producers. Features of their synthesis and localization in plants. Plant cell cultures. Basic approaches to the intensification and control of secondary metabolite biosynthesis in plant cell cultures.
20. Methods of stabilization of cloned proteins. Chimeric proteins. Application of chimeric proteins.
21. “Antisense " nucleotides. Ribozymes.
22. Production of amino acids. The main ways to get it. Their advantages and disadvantages. Conditions and basic approaches to amino acid supersynthesis.
23. Methods of microbial biotransformation of organic compounds.
24. Immobilized enzymes and cells. Advantages of immobilized biocatalysts.
25. Genetically engineered vaccines.
26. Surface cultivation of producers.
27. Deep cultivation of producers. The main ways of organizing the process of deep cultivation (periodic, semi-periodic, continuous).

28. The use of monoclonal antibodies as drugs.
29. Biotechnology in solving environmental problems and eliminating anthropogenic impacts on the environment.
30. Using methods of combinatorial chemistry and HTSscreening to search for new biologically active substances.
31. Preparation and sterilization of culture media and equipment. Preparation of air for surface and deep cultivation. Preparation of the producer's culture.
32. The concept of monoclonal antibodies. Preparation of monoclonal antibodies.
33. Genomics. Proteomics. Bioinformatics. Using the achievements of genomics, proteomics, and bioinformatics to produce new-generation drugs.Ivet genesand conserved peptides as potential targets for new-generation drugs.
34. Maintenance of sterile conditions during fermentation. Temperature control. Defoaming. Control and management of processes.
35. Preparation of recombinant proteins (insulin, somatostatin, somatotropin, interferon). Use of transgenic animals for their production.
36. Exo-and endometabolites. Methods of isolation and purification of products.
37. Using genetic engineering to improve the production of antibiotics.
38. Features of isolation and drying of protein products.
39. Methods of isolation of transformed cells (cloning).
40. Secondary metabolites. Key representatives. The role of secondary metabolites. Antibiotics, alkaloids, steroids, vitamins. Main producers.
41. Features of the organization of the process of cultivation of cell cultures and tissues of animals and plants.
42. Engineering enzymology. Classification and use of enzyme preparations. Enzyme preparations in medicine.
43. Recombinant DNA. Methods for obtaining recombinant DNA.
44. The main areas of application of immobilized biocatalysts.
45. The concept of a vector. Basic types of vectors. Transformation and transfection.
46. Fundamentals of antibiotic production technology.
47. Using genetic engineering to improve the production of non-protein medicinal substances (obtaining ascorbic acid).
48. "Medical chemistry". Basic approaches to the development of new-generation medicines. Rational drug design.

Question	Competence code (according to the WPD)
1	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
2	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
3	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
4	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
5	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
6	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
7	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
8	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
9	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
10	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
11	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
12	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
13	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
14	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
15	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
16	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
17	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7

18	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
19	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
20	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
21	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
22	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
23	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
24	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
25	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
26	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
27	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
28	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
29	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
30	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
31	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
32	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
33	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
34	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
35	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
36	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
37	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
38	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
39	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
40	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
41	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
42	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
43	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
44	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
45	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
46	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
47	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7
48	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7

6. Criteria for evaluating learning outcomes

Learning outcomes	**Evaluation criteria**	
	Not passed	**Passed**
Completeness of knowledge	The level of knowledge is below the minimum requirements. There were bad mistakes.	The level of knowledge in the volume corresponding to the training program. Minor mistakes may be made
Availability of skills	Basic skills are not demonstrated when solving standard tasks. There were bad mistakes.	Basic skills are demonstrated. Typical tasks have been solved, all tasks have been completed. Minor mistakes may be made.
Availability of skills (possession of experience)	Basic skills are not demonstrated when solving standard tasks. There were bad mistakes.	Basic skills in solving standard tasks are demonstrated. Minor mistakes may be made.
Motivation (personal attitude)	Educational activity and motivation are poorly expressed, there is no willingness to solve the tasks qualitatively	Educational activity and motivation are manifested, readiness to perform assigned tasks is demonstrated.

Characteristics of competence formation*	The competence is not fully formed. The available knowledge and skills are not enough to solve practical (professional) tasks. Repeated training is required	The competence developed meets the requirements. The available knowledge, skills and motivation are generally sufficient to solve practical (professional) tasks.
The level of competence formation*	Low	Medium/High

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