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**Federal State Autonomous Educational Institution for Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA named after P. Lumumba
(RUDN University)
Science faculty**

educational division (faculty/institute/academy) as higher education programme developer

COURSE SYLLABUS

Fundamentals of Biotechnology

course title

Recommended by the Didactic Council for the Education Field of:

04.04.01 «Chemistry»

field of studies / speciality code and title

The course instruction is implemented within the professional education programme of higher education:

«Fundamental and applied Chemistry»

higher education programme profile/specialisation title

1. COURSE GOAL(s)

The goal of the course of « Fundamentals of Biotechnology » is in the formation of the system of knowledge about biological targets, structure-activity relationship and modern methodology for the design of medicinal substances.

2. REQUIREMENTS FOR LEARNING OUTCOMES

Mastering the discipline "Fundamentals of Biotechnology" is aimed at developing the following competencies (parts of competencies) among students:

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

Competence code	Competence descriptor	Competence formation indicators (within this course)
M-PC-1-s	The ability to plan work and choose adequate methods for solving research problems in the chosen field of chemistry, chemical technology or sciences related to chemistry	M-PC-1-s-1. Draws up a general research plan and detailed plans for individual stages
		M-PC-1-s-2. Selects experimental and computational-theoretical methods for solving the problem based on the available material and time resources
M-PC-2-s	Ability to conduct patent information research in the chosen field of chemistry and/or related sciences	M-PC-2-s-1. Searches for specialized information in patent information databases
		M-PC-2-s-2. Analyzes and summarizes the results of a patent search on the subject of the project in the selected field of chemistry (chemical technology)

3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The course "Fundamentals of Biotechnology" refers to the elective component of (B1) block of the higher educational programme curriculum.

Within the higher education programme students also master other (modules) and / or internships that contribute to the achievement of the expected learning outcomes as results of the course study.

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

Competence code	Competence descriptor	Previous courses/modules*	Subsequent courses/modules*
M-PC-1-s	The ability to plan work and choose adequate methods for solving research problems in the chosen field of chemistry, chemical technology or sciences related to chemistry	Actual problems of modern chemistry Theoretical organic chemistry Methods of organic chemistry Domino reactions in the synthesis of heterocycles NMR of organic compounds Molecular spectral analysis	Undergraduate practice

Competence code	Competence descriptor	Previous courses/modules*	Subsequent courses/modules*
		Methodology for working with the database Chemistry of heterocyclic compounds Fundamentals of experimental research methods in CHC Experimental research methods in organic chemistry research	
M-PC-2-s	Ability to conduct patent information research in the chosen field of chemistry and/or related sciences	Actual problems of modern chemistry Theoretical organic chemistry Methods of organic chemistry Domino reactions in the synthesis of heterocycles NMR of organic compounds Molecular spectral analysis Methodology for working with the database Chemistry of heterocyclic compounds Fundamentals of experimental research methods in CHC Experimental research methods in organic chemistry research	Undergraduate practice

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

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

Course workload of the course «Fundamentals of Biotechnology» is 2 credits.

Table 4.1. Types of academic activities during the periods of higher education programme mastering (full-time training)

Types of academic activities	Total academic hours	Semester(-s)			
		1	2	3	4
Contact academic hours	36	36			
including:					
Lectures (LC)	36	36			
Lab Works (LW)					

Types of academic activities		Total academic	Semester(-s)			
			1	2	3	4
Seminars (PC)						
Seminars (workshops/tutorials) (S)		18	18			
Evaluation and assessment (exam/passing/failing grade)		18	18			
Course workload	academic hours	72	72			
	credits	2	2			

5. COURSE CONTENTS

Table 5.1. Course contents and academic activities types

Course module title	Course module contents (topics)	Academic activities types
Section 1. Introduction. Objects of biotechnological productions.	Theme 1.1. The subject of biotechnology. History of the development of biotechnology. Goals and objectives of biotechnology. The main modern fields of application and prospects for biotechnological processes.	LC
	Theme 1.2. Classification of organisms-producers. The structure and chemical composition of the cells of bacteria, plants, fungi and animals. Criteria for the selection of biological objects.	LC
Section 2. Fundamentals of genetic engineering. Biotechnological process.	Theme 2.1. Structure and functions of DNA and RNA. Genetic engineering methods for creating objects of biotechnological production. Principles of genetic engineering.	LC
	Theme 2.2. The main stages of biotechnological production. Cultivation of biological objects. Designs of bioreactors providing optimal conditions for fermentation.	LC
Section 3. Fermentation and fermentation production.	Theme 3.1. Glycolysis and fermentation. Production of ethanol and spirits. The use of yeast for the production of protein mass. Butyric and acetone-butyl fermentation.	LC
	Theme 3.2. Lactic acid fermentation. Composition and processing of milk. Production of dairy products and cheese.	LC
Section 4. Enzymes in biotechnology. Production of organic acids and carbohydrates.	Theme 4.1. Applications and types of enzymes in biotechnology, industry, household chemicals, medicine. Methods for isolation and purification of enzymes. Immobilized enzymes.	LC
	Theme 4.2. Production of acids: acetic, propionic, gluconic, citric. Biotechnological production of fructose syrup, polysaccharides (dextrans, xanthan). Production of α -amino acids.	LC

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

6. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Classroom Equipment and Technology Support Requirements

Type of academic activities	Classroom equipment	Specialised educational / laboratory equipment, software, and materials for course study (if necessary)
Lecture	A lecture hall for lecture-type classes, equipped with a set of specialised furniture; board (screen) and technical means of multimedia presentations.	
Self-studies	A classroom for independent work of students (can be used for seminars and consultations), equipped with a set of specialised furniture and computers with access to the electronic information and educational environment.	

7. RESOURCES RECOMMENDED FOR COURSE STUDY

Main readings:

1. *Basic Biotechnology*, 3. ed., reprinted.; Ratledge, C., Kristiansen, B., Eds.; Cambridge Univ. Press: Cambridge, 2007.
2. Glick, B. R.; Pasternak, J. J. *Molecular Biotechnology: Principles and Applications of Recombinant DNA*, 3. ed.; American Society for Microbiology: Washington, DC, 2003.

Additional readings:

1. Основы биотехнологии: Учебное пособие / Т.А. Егорова, С.М. Клунова, Е.А. Живухина; Т.А.Егорова и др. - 2-е изд., стереотип. - М. : Академия, 2005. - 208 с.
2. Основы биотехнологии: Учебное пособие / Н.С. Простаков, Т.Н. Борисова; РУДН. - М. : Изд-во РУДН, 1992. - 111 с.
3. Биотехнология. Принципы и применение / Под ред. И.Хиггинса; Пер. с англ. А.С.Антонова; Под ред. А.А.Баева. - М. : Мир, 1988. - 479 с.
4. Б.Глик, Дж. Пастернак. Молекулярная биотехнология. Принципы и применение. Пер. с англ. – М: Мир, 2002.
5. Р.Д.Шмид. Наглядная биотехнология. Пер. с нем. – М., Бином, 2009.

Internet sources

1. Electronic libraries (EL) of RUDN University and other institutions, to which university students have access on the basis of concluded agreements:
 - RUDN Electronic Library System (RUDN ELS) <http://lib.rudn.ru/MegaPro/Web>
 - EL "University Library Online" <http://www.biblioclub.ru>
 - EL "Yurayt" <http://www.biblio-online.ru>
 - EL "Student Consultant" www.studentlibrary.ru
 - EL "Lan" <http://e.lanbook.com/>
 - EL "Trinity Bridge"
 - Journal "Nature Biotechnology": <https://www.nature.com/nbt/>

2. Databases and search engines:

- Yandex search engine <https://www.yandex.ru/>
- Google search engine <https://www.google.ru/>
- abstract database SCOPUS <http://www.elsevierscience.ru/products/scopus/>
- database Reaxys <https://www.reaxys.com/#/search>

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

1. Course of lectures on the discipline “Fundamentals of Drug Design”.

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

8. ASSESSMENT TOOLKIT AND GRADING SYSTEM* FOR EVALUATION OF STUDENTS' COMPETENCES LEVEL UPON COURSE COMPLETION

The assessment toolkit and the grading system* to evaluate the competences formation level (competences in part) upon the course study completion are specified in the Appendix to the course syllabus.

* The assessment toolkit and the grading system are formed on the basis of the requirements of the relevant local normative act of RUDN University (regulations / order).


DEVELOPERS:

Associate Professor of Organic Chemistry Department		N. E. Golantsov
Position, Department	Signature	name and surname

HEAD OF EDUCATIONAL DEPARTMENT:

Organic Chemistry Department		L. G. Voskressensky
Name of Department	Signature	name and surname

HEAD OF HIGHER EDUCATION PROGRAMME:

Dean of Science faculty, Head of the Department of Organic Chemistry		L. G. Voskressensky
Position, Department	Signature	name and surname