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**Federal State Autonomous Educational Institution of Higher Education  
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA named after Patrice Lumumba  
RUDN University**

**Faculty of Science**

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

**INTERNSHIP SYLLABUS**

Pre-graduation practical training

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internship title

Work practice

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internship type

**Recommended by the Didactic Council for the Education Field of:**

04.04.01 "Chemistry"

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field of studies / speciality code and title

**The student's internship is implemented within the professional education programme of higher education:**

«Bioenergies and Biorefineries»

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higher education programme profile/specialisation title

**2024**

## 1. INTERNSHIP GOAL

The goal of the internship is obtaining the skills and abilities to conduct independent scientific research under the guidance of qualified specialists from among the teachers and employees of the department and the partner university, mastering the methodology of modern scientific research, preparing the final qualifying work

## 2. REQUIREMENTS FOR LEARNING OUTCOMES

The internship implementation is aimed at the development of the following competences (competences in part):

*Table 2.1. List of competences that students acquire during the internship*

Competence code	Competence descriptor	Competence formation indicators (within this course)
<b>GC-1</b>	Ability to carry out critical analysis of problem tasks applying a systematic approach, to develop an action strategy.	<b>GC-1.1.</b> Ability to analyze the problem task as a system, identifying its components and relationships between them.
		<b>GC-1.2.</b> Ability to identify lack in information needed to solve a problem task and to design processes to address them.
		<b>GC-1.3.</b> Ability to critically evaluate the reliability of information sources, to work with conflicting information from different sources.
		<b>GC-1.4.</b> Ability to develop and substantively argue a strategy for solving a problem situation based on a systematic and interdisciplinary approach.
<b>GC-2</b>	Ability to manage a project at all stages of its life cycle.	<b>GC-2.1.</b> Ability to formulate, on the basis of the posed problem, a project task and a way to solve it through the implementation of project management.

Competence code	Competence descriptor	Competence formation indicators (within this course)
		<p><b>GC-2.2.</b> Ability to develop the project concept within the framework of the designated problem: to formulate the goal, objectives, to justify the relevance, significance, expected results and possible areas of their application.</p> <p><b>GC-2.3.</b> Ability to plan the necessary resources, including taking into account their replaceability.</p> <p><b>GC-2.4.</b> Ability to develop a project implementation plan using planning tools.</p> <p><b>GC-2.5.</b> Ability to monitor the progress of the project, to correct deviations, to make additional changes to the project implementation plan, to clarify the areas of responsibility of the project participants.</p>
<b>GC-3</b>	Ability to organize and manage the work of the team, developing a team strategy to achieve the goal.	<p><b>GC-3.3.</b> Ability to resolve conflicts and contradictions in business communication based on the interests of all parties</p> <p><b>GC-3.4.</b> Ability to organize discussions on a given topic and discussion of the results of the team's work with the involvement of opponents of the developed ideas</p> <p><b>GC-3.5.</b> Ability to plan team work, distribute tasks and delegates authority to team members</p>
<b>GC-4</b>	Ability to apply modern communication technologies, including foreign language(s), for academic and professional	<b>GC-4.1.</b> Ability to establish and develop professional contacts in accordance with the needs of joint activities, including the exchange of information and the development of a common strategy for interaction.

Competence code	Competence descriptor	Competence formation indicators (within this course)
	interaction	<b>GC-4.2.</b> Ability to compile, translate and edit various academic texts (abstracts, essays, reviews, articles, etc.),
		<b>GC-4.3.</b> Ability to present the results of academic and professional activities at various social events, including collections, choosing the most appropriate format.
		<b>GC-4.4.</b> Ability to argue and constructively defend the positions and ideas in academic and professional discussions in the state language of the Russian Federation and in a foreign language.
<b>GC-5</b>	Ability to analyze and perceive the diversity of cultures in the process of intercultural interaction	<b>GC-5.1.</b> Ability to analyze the most important ideological and value systems formed in the course of historical development; substantiates the relevance of their use in social and professional interaction
		<b>GC-5.2.</b> Ability to build social and professional interaction, taking into account the characteristics of the main forms of scientific and religious consciousness, business and general culture of representatives of other ethnic groups and confessions, various social groups
		<b>GC-5.3.</b> Ability to ensure the creation of a non-discriminatory environment for interaction when performing professional tasks
<b>GC-6</b>	Ability to identify and implement the priorities of their own activities and self-development based on self-assessment.	<b>GC-6.1.</b> Ability to evaluate their resources and their limits (personal, situational, temporary), optimally use them for the successful completion of the assigned task.
	Ability to look for the necessary sources of information and data, perceive, analyze, memorize and transmit information using digital means, as well as using algorithms when working	<b>GC-7.1.</b> Ability to use digital technologies and methods of searching, processing, analyzing, storing and presenting information in the field of chemistry.
		<b>GC-7.2.</b> Ability to develop the conception of digital technologies and methods of searching, processing, analyzing, storing and presenting information within

Competence code	Competence descriptor	Competence formation indicators (within this course)
GC-7	with data obtained from various sources in order to effectively use the information received to solve problems; evaluate information, its reliability,	the framework of the designated problem: to be able to formulate the purpose, objectives, justify the relevance, significance, expected results and possible areas of their application in the digital economy and modern corporate information culture.
		<b>GC-7.3.</b> Ability to monitor the use of digital technologies and methods of search, processing, analysis, storage and presentation of information in the field of chemistry, corrects deviations, makes additional changes to the plan for the use of digital technologies.
GPC-1	Ability to carry out complex experimental and computational-theoretical studies in the chosen field of chemistry or related sciences using modern equipment, software and databases for professional purposes.	<b>GPC-1.1.</b> Ability to use existing and to develop new methods for obtaining and characterizing substances and materials for solving problems in the chosen field of chemistry or related sciences.
		<b>GPC-1.2.</b> Ability to use modern equipment, software and professional databases for solving problems in the chosen field of chemistry or related sciences
		<b>GPC-1.3.</b> Ability to use modern computational and theoretical methods of chemistry to solve professional problems.
GPC-2	Ability to analyze, interpret and generalize the results of experimental and computational-theoretical work in the chosen field of chemistry or related sciences.	<b>GPC-2.1.</b> Ability to carry out a critical analysis of the results of own experimental and computational-theoretical works and to correctly interpret them.
		<b>GPC-2.2.</b> Ability to formulate summary and conclusions based on the results of the analysis of literature data, own experimental and computational-theoretical works in the chosen field of chemistry or related sciences.
GPC-3	Ability to use computational methods and adapt existing software products to solve	<b>GPC-3.1.</b> Ability to use modern IT-technologies in the collection, analysis, and presentation of chemical profile information.

Competence code	Competence descriptor	Competence formation indicators (within this course)
	problems of professional activity.	<p><b>GPC-3.2.</b> Ability to use standard and original software products, if necessary, adapting them to solve the problems of professional activity.</p> <p><b>GPC-3.3.</b> Ability to use modern computational methods for processing chemical experiment data, modeling the properties of substances (materials) and processes with their participation.</p>
<b>GPC-4</b>	Ability to prepare publications, participate in professional discussions, present the results of professional activities in the form of scientific and popular science reports.	<p><b>GPC-4.1.</b> Ability to present the results of the research in the form of scientific publications (abstract, paper, review) in Russian and in English</p> <p><b>GPC-4.2.</b> Ability to present the results of the research orally in Russian and English</p>
<b>PC-1</b>	The ability to develop a work plan and to choose adequate methods for solving research problems in the chosen field of chemistry, chemical technology or sciences related to chemistry	<p><b>PC-1.1.</b> Ability to prepare a general plan of research and detailed plans for individual stages.</p> <p><b>PC-1.2.</b> Ability to select experimental and calculation-theoretical methods for solving the problems based on the available material and time resources.</p>
<b>PC-2</b>	Ability, based on a critical analysis of the results of research and development, to evaluate the prospects for their practical application and continuation of work in the chosen field of chemistry, chemical technology or sciences related to chemistry.	<p><b>PC-2.1.</b> Ability to systematize information obtained in the course of research and development, to analyze it and compare it with literature data.</p> <p><b>PC-2.2.</b> Ability to determine possible directions for the development of work and prospects for the practical application of the results obtained.</p>

### 3. INTERNSHIP IN HIGHER EDUCATION PROGRAMME STRUCTURE

The internship refers to the core component of the higher educational programme curriculum.

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

*Table 3.1. The list of the higher education programme components that contribute to the achievement of the expected learning outcomes as the internship results*

<b>Competence code</b>	<b>Competence descriptor</b>	<b>Previous courses/modules, internships*</b>	<b>Subsequent courses/modules, internships*</b>
<b>GC-1</b>	Ability to carry out critical analysis of problem tasks applying a systematic approach, to develop an action strategy.	Actual problems of modern chemistry Student Scientific-Research work	Writing, preparation for the graduate qualification work defense and graduate qualification work defense
<b>GC-2</b>	Ability to manage a project at all stages of its life cycle.	Bioenergy Student Scientific-Research work	Writing, preparation for the graduate qualification work defense and graduate qualification work defense
<b>GC-3</b>	Ability to organize and manage the work of the team, developing a team strategy to achieve the goal.	Foreign language in professional activity Experimental lab 1: Flow + alternative technologies Experimental lab 2: Biorefineries and Bioproducts Experimental lab 3: Advanced Organic Synthesis Student Scientific-Research work	Writing, preparation for the graduate qualification work defense and graduate qualification work defense
<b>GC-4</b>	Ability to apply modern communication technologies, including foreign language(s), for academic and professional interaction.	Foreign language in professional activity Student Scientific-Research work	Writing, preparation for the graduate qualification work defense and graduate qualification work defense

Competence code	Competence descriptor	Previous courses/modules, internships*	Subsequent courses/modules, internships*
<b>GC-5</b>	Ability to analyze and perceive the diversity of cultures in the process of intercultural interaction.	Foreign language in professional activity	Writing, preparation for the graduate qualification work defense and graduate qualification work defense
<b>GC-6</b>	Ability to identify and implement the priorities of their own activities and self-development based on self-assessment.	Actual problems of modern chemistry Student Scientific-Research work	Writing, preparation for the graduate qualification work defense and graduate qualification work defense
<b>GC-7</b>	Ability to look for the necessary sources of information and data, perceive, analyze, memorize and transmit information using digital means, as well as using algorithms when working with data obtained from various sources in order to effectively use the information received to solve problems; evaluate information, its reliability, build logical conclusions based on incoming information and data.	The method of working with databases Artificial intelligence and additive technologies in chemistry Student Scientific-Research work	Writing, preparation for the graduate qualification work defense and graduate qualification work defense
<b>GPC-1</b>	Ability to carry out complex experimental and computational-theoretical studies in the chosen field of chemistry or related	Actual problems of modern chemistry Bioenergy Advanced Organic Synthesis Alternative / new tools for organic synthesis	Writing, preparation for the graduate qualification work defense and graduate qualification work defense



Competence code	Competence descriptor	Previous courses/modules, internships*	Subsequent courses/modules, internships*
	<p>sciences using modern equipment, software and databases for professional purposes.</p>	<p>Catalyst (nanomaterials) design and applications  Catalysis: from Basic principles to applications. Homogeneous, Heterogeneous, PhotoCatalysis, Biocatalysis, Electrocatalysis  Experimental lab 1: Flow + alternative technologies  Experimental lab 2: Biorefineries and Bioproducts  Experimental lab 3: Advanced Organic Synthesis  Student Scientific-Research work</p>	
<b>GPC-2</b>	<p>Ability to analyze, interpret and generalize the results of experimental and computational-theoretical work in the chosen field of chemistry or related sciences.</p>	<p>Actual problems of modern chemistry  Bioenergy  Advanced Organic Synthesis  Alternative / new tools for organic synthesis  Catalyst (nanomaterials) design and applications  Catalysis: from Basic principles to applications. Homogeneous, Heterogeneous, PhotoCatalysis, Biocatalysis, Electrocatalysis  Experimental lab 1: Flow + alternative technologies  Experimental lab 2: Biorefineries and Bioproducts  Experimental lab 3: Advanced Organic Synthesis</p>	<p>Writing, preparation for the graduate qualification work defense and graduate qualification work defense</p>

Competence code	Competence descriptor	Previous courses/modules, internships*	Subsequent courses/modules, internships*
		Student Scientific- Research work	
<b>GPC-3</b>	Ability to use computational methods and adapt existing software products to solve problems of professional activity.	Bioenergy Bioproducts and Biorefineries Catalyst (nanomaterials) design and applications Experimental lab 3: Advanced Organic Synthesis Student Scientific- Research work	Writing, preparation for the graduate qualification work defense and graduate qualification work defense
<b>GPC-4</b>	Ability to prepare publications, participate in professional discussions, present the results of professional activities in the form of scientific and popular science reports.	Actual problems of modern chemistry Foreign language in professional activity Student Scientific- Research work	Writing, preparation for the graduate qualification work defense and graduate qualification work defense
<b>PC-1</b>	Ability to develop a work plan and to choose adequate methods for solving research problems in the chosen field of chemistry, chemical technology or sciences related to chemistry.	Modern organic synthesis and pharmacology Alternative / new tools for organic synthesis Advanced Organic Synthesis Catalyst (nanomaterials) design and applications Experimental lab 1: Flow + alternative technologies Experimental lab 2: Biorefineries and Bioproducts Experimental lab 3: Advanced Organic Synthesis Emerging contaminants: from fate to environmental remediation	Writing, preparation for the graduate qualification work defense and graduate qualification work defense

Competence code	Competence descriptor	Previous courses/modules, internships*	Subsequent courses/modules, internships*
		The method of working with databases Student Scientific-Research work	
PC-2	Ability, based on a critical analysis of the results of research and development, to evaluate the prospects for their practical application and continuation of work in the chosen field of chemistry, chemical technology or sciences related to chemistry.	Bioproducts and Biorefineries Catalyst (nanomaterials) design and applications Experimental lab 1: Flow + alternative technologies Experimental lab 3: Advanced Organic Synthesis Advanced Organic Synthesis Student Scientific-Research work Artificial intelligence and additive technologies in chemistry	Writing, preparation for the graduate qualification work defense and graduate qualification work defense

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

#### 4. INTERNSHIP CONTENTS

The total workload of the internship is 24 credits (864 academic hours).

*Table 5.1. Internship contents \**

Modules	Contents (topics, types of practical activities)	Workload, academic hours
Module 1. Preparatory	Acquaintance with the goals and objectives of the pre-graduation practice.	36
	Choice of research topic. Definition of the object and subject of research. Justification of the relevance of the chosen topic. Drawing up a plan for scientific research.	
Module 2. Scientific Research	Fulfillment of an individual task. Safety precautions instruction.	468
	Collection, processing and systematization of analytical and experimental material. Determination of the properties of the object of study, the state of the study area. Conducting research as part of an individual assignment.	

<b>Modules</b>	<b>Contents (topics, types of practical activities)</b>	<b>Workload, academic hours</b>
	Team selection for individual experiments.	
Module 3. Analytical	Fulfillment of an individual task, collection, processing of experimental and analytical material for an internship report.	342
	Анализ полученной информации.	
	Preparation of a report on the passage of introductory practice.	
Module 4. Reporting	Preparation of a practice report	18
	Preparing for defence and defending the internship report.	
<b>TOTAL:</b>		<b>864</b>

\* The contents of internship through modules and types of practical activities shall be FULLY reflected in the student's internship report.

## **6. INTERNSHIP EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS**

RUDN University and partner universities have a material and technical base that complies with the current fire rules and regulations and provides practical and research work for students. There are scientific laboratories for research, classrooms for group and individual consultations, rooms for independent work of students, equipped with computers providing opportunity to use the Internet and access to the RUDN University electronic information and educational environment. Scientific laboratories and classrooms are equipped with specialized furniture and teaching aids. Each student is provided with individual unlimited access to the electronic library systems “Yurayt”, “LAN”, etc., access to the electronic information and educational environment of RUDN University named after Patrice Lumumba. Licensed or freely distributed software is used.

## **7. INTERNSHIP LOCATION AND TIMELINE**

The internship can be carried out at the structural divisions of RUDN University at Moscow-based organizations, as well as those located outside Moscow.

The internship at an external organization (outside RUDN University) is legally arranged on the grounds of an appropriate agreement, which specifies the terms, place and conditions for an internship implementation at the organization.

The period of the internship, as a rule, corresponds to the period indicated in the training calendar of the higher education programme. However, the period of the internship can be rescheduled upon the agreement with the Department of Educational Policy and the Department for the Organization of Internship and Employment of RUDN students.

## **8. RESOURCES RECOMMENDED FOR INTERNSHIP**

*Main sources:*

1. Texts of international scientific journals World Scientific Publishing:

<http://www.worldscinet.com/>

Abstracts and full texts of articles from journals, books, book series, electronic links of scientific publishers:

- Springer Verlag <http://springerlink.com/>
- Blackwell Publishing <http://www.blackwellpublishing.com/contacts/>
- POLYMERSnetBASE <http://www.polymersnetbase.com/>
- Chemical Abstracts <http://chemabs.cas.org>
- The Royal Society Of Chemistry <http://www.rsc.org>
- American Chemical Society <http://pubs.acs.org>
- The Electrochemical Society <http://www.electrochem.org>

*Additional sources:*

1. VINITI databases (periodicals, books, company publications, conference materials, theses, patents, regulations, deposited scientific papers) <http://www.viniti.ru/bnd.html>

*Internet sources*

1. Electronic libraries with access for RUDN students:

- 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](http://www.studentlibrary.ru)
- EL "Lan" <http://e.lanbook.com/>
- EL "Trinity Bridge"

2. Databases and search engines:

- electronic foundation of legal and normative-technical documentation <http://docs.cntd.ru/>
- Yandex search engine <https://www.yandex.ru/>
- Google search engine <https://www.google.ru/>
- Scopus abstract database <http://www.elsevierscience.ru/products/scopus/>
- American Chemical Society: [www.pubs.acs.org](http://www.pubs.acs.org)
- Journals of the Royal Chemical Society: <http://pubs.rsc.org/en/journals/>.

*The training toolkit and guidelines for a student to do an internship, keep an internship diary and write an internship report\*:*

1. Safety regulations to do the internship (safety awareness briefing).
2. Machinery and principles of operation of technological production equipment used by students during their internship; process flow charts, regulations, etc. (if necessary).
3. Guidelines for keeping an internship diary and writing an internship report.
4. Guidelines for preparation of the report.

\*The training toolkit and guidelines for the internship are placed on the internship 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 AS INTERNSHIP RESULTS**

The assessment toolkit and the grading system\* to evaluate the level of competences (competences in part) formation as the internship results are specified in the Appendix to the internship 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:**

**Assistant professor of Organic**

**Chemistry Department**

**Voskressensky L.G.**

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position, educational department

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signature

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name and surname

**HEAD OF EDUCATIONAL**

**DEPARTMENT:**

**Organic Chemistry Department**

**Voskressensky L.G.**

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position, educational department

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signature

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name and surname

**HEAD OF**

**HIGHER EDUCATION PROGRAMME:**

**Dean of Faculty of Science,**

**Head Organic Chemistry**

**Department**

**Voskressensky L.G.**

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position, educational department

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signature

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name and surname