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**Federal State Autonomous Educational Institution of Higher Education  
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA NAMED AFTER PATRICE  
LUMUMBA  
RUDN University**

**Academy of Engineering**

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

**COURSE SYLLABUS**

**Sustainability in Civil Engineering**

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course title

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

**08.04.01 Civil Engineering**

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field of studies / speciality code and title

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

**Civil Engineering and Built Environment**

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higher education programme profile/specialisation title

**2025**

## 1. COURSE GOAL(s)

The goal of the course Sustainability in Civil Engineering is the training of qualified specialists who have knowledge in the field of current architectural and construction models in the system of "green" buildings in the context of global adaptive architecture, necessary for practical work in the field of architectural design, construction, reconstruction and operation of structures during their life cycle.

The main objective of studying the course Sustainability in Civil Engineering is the study by students of modern methods and principles of designing eco-buildings in the Russian Federation and abroad, the principles and criteria for eco-certification of "green" construction objects, familiarization with international trends in the design of energy efficient buildings, as well as the application of ways to improve the energy efficiency of buildings when using various types of energy resources.

## 2. REQUIREMENTS FOR LEARNING OUTCOMES

The course Sustainability in Civil Engineering implementation is aimed at the development of the following competences (competences in part):

*Table 2.1. List of competences that students acquire during the course «Sustainability in Civil Engineering»*

| Competence code | Competence descriptor   | Competence formation indicators<br>(within this course)  |
|-----------------|---|--|
| PC-1            | Conducting scientific research in the field of construction   | PC-1.1 Able to carry out planning, preparation for research;<br>PC-1.2 Able to carry out, control, receive research results;<br>PC-1.3 Able to analyze and process research results;<br>PC-1.4 Knows how to draw up, coordinate, and present the results of completed research   |
| PC-2            | Development of project products based on the results of engineering and technical design for urban development activities | PC-2.1 Capable of performing engineering and technical design and developing design products for building structures, grounds and foundations;<br>PC-2.2 Able to perform engineering and technical design and develop design products for engineering systems and engineering structures;<br>PC-2.3 Is able to perform organizational and technological design and develop construction organization projects and work production projects |

## 3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The course Sustainability in Civil Engineering refers to the *elective component* of (B1) block 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 course Sustainability in Civil Engineering.

*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.*

| Competence code | Competence descriptor                                       | Previous courses / modules, internships                                     | Subsequent courses / modules, internships             |
|-----------------|---|---|---|
| PC-1            | Conducting scientific research in the field of construction | Problem solving techniques in Civil Engineering;<br>Nanotechnology in Civil | Independent Research Work;<br>Pre-Graduation Practice |

|      |   |  |   |
|------|---|--|---|
|      |   | Engineering;<br>Building materials:<br>Special Topics  |   |
| PC-2 | Development of project products based on the results of engineering and technical design for urban development activities | Digital technologies in construction;<br>Structural Design in Steel;<br>Nanotechnology in Civil Engineering;<br>Structural Design in Reinforced Concrete:<br>Special Topics;<br>Structural Dynamics;<br>Structural Design in Reinforced Concrete;<br>Building materials:<br>Special Topics;<br>Structural Design in Steel:<br>Special Topics;<br>Modelling of Construction Processes | Desin Practice;<br>Technological Practice;<br>Pre-Graduation Practice |

#### 4. COURSE WORKLOAD

The total workload of the course Sustainability in Civil Engineering is 3 credits.

Table 4.1. Academic activities types by periods of the higher education programme

| Type of academic activities              |                | Total academic hours | Semester(s) |  |  |  |
|--|----------------|----------------------|-------------|--|--|--|
|  |                |                      | 3           |  |  |  |
| Contact academic hours                   |                | 36                   | 36          |  |  |  |
| including:                               |                |                      |             |  |  |  |
| Lectures (LC)                            |                | 18                   | 18          |  |  |  |
| Lab works (LW)                           |                | 0                    | 0           |  |  |  |
| Seminars (workshops / tutorials) (S)     |                | 18                   | 18          |  |  |  |
| Self-studies academic hours              |                | 45                   | 45          |  |  |  |
| Evaluation and assessment academic hours |                | 27                   | 27          |  |  |  |
| Course work / project, credits           |                |                      |             |  |  |  |
| Course workload                          | academic hours | 108                  | 108         |  |  |  |
|  | credits        | 3                    | 3           |  |  |  |

#### 5. COURSE CONTENTS

| Modules   | Contents (topics)   | Academic activities types * |
|---|---|-----------------------------|
| Section 1.<br>Conceptual development of a typology of | Topic 1.1. Introduction to the basic terminology of sustainable buildings. Principles of formation of | LC, S                       |

| Modules   | Contents (topics)  | Academic activities types * |
|---|--|-----------------------------|
| sustainable buildings   | <p>sustainable architecture. Energy efficient (passive, active) and smart buildings.</p> <p>Topic 1.2. Methods and technologies for saving different types of energy and resources.</p> <p>Topic 1.3. Factors of influence on the process of viability and "sustainable" development of buildings and structures. The concept of "life cycle of the building". Organizational structure of buildings.</p> <p>Topic 1.4. Main trends in the development of modern urban planning. Above-ground and underground types of "green buildings". adaptive architecture.</p> <p>Topic 1.5. Eco-certification of "green" construction objects in Russia and abroad. LEAD, BREAM, DGNB, Green Zoom, Well, Fit Well –international and local certification systems. The main principals and criteria of certification</p>   |                             |
| Section 2. Architectural and space-planning solution for energy-efficient buildings | <p>Topic 2.1. Typology of energy efficient buildings. Overview of the first projects of energy efficient buildings. Definition of the basic principle of energy efficient buildings.</p> <p>Topic 2.2. Typology of buildings according to the method of extracting energy from natural factors (solar buildings, wind-powered, hydropower-active and buried dwellings). "Active" and "passive" houses.</p> <p>Topic 2.3. Accounting for regional specifics in the design of energy efficient buildings. Stages of designing an energy-efficient building. Factors taken into account when designing, reconstructing and evaluating energy-efficient buildings (climate of the area and orientation of buildings, solar radiation and insolation, aeration and wind regime, type of landscape of the building site, main patterns of microclimate formation in various conditions of the underlying surface). Gardening and improvement.</p> <p>Topic 2.4. Types of space-planning solutions for energy-efficient buildings. Determination of rational features of space-planning solutions for energy-efficient houses.</p> <p>Experience in the design and construction of energy efficient and passive buildings in Europe and in Russia. Examples of implemented sustainable buildings: townhouses, cottages, apartment buildings, schools, office and administrative buildings, reconstruction of old buildings. Features of designing energy efficient and passive buildings in Asian countries. Examples</p> | LC, S                       |

| Modules | Contents (topics)  | Academic activities types * |
|---------|--|-----------------------------|
|         | of the implementation of energy efficient buildings in Asian countries. Design and construction of energy efficient and passive buildings in the USA and Canada. |                             |

\* - 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   | Specialized educational / laboratory equipment, software and materials for course study (if necessary) |
|-----------------------------|---|--|
| Lectures                    | An auditorium for conducting lectures, equipped with a set of specialized furniture; a blackboard (screen) and technical means for multi-media presentations.   |  |
| Seminars                    | A classroom for conducting seminars, group and individual consultations, current and midterm assessment; equipped with a set of specialised furniture and technical means for multimedia presentations.                     |  |
| Computer Labs               | Not required  |  |
| 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 INTERNSHIP

*Main readings:*

1. Andrew Braham, Sadie Casillas. Fundamentals of Sustainability in Civil Engineering/ CRC Press; 2nd Edition. 2024. - 272 p.

*Additional readings:*

1. Kiani Mavi, R.; Gengatharen, D.; Kiani Mavi, N.; Hughes, R.; Campbell, A.; Yates, R. Sustainability in Construction Projects: A Systematic Literature Review/ Sustainability 2021, 13, 1932. <https://doi.org/10.3390/su13041932>

2. Engineering Sustainability. Proceedings of the Institution of Civil Engineers. ISSN 1478-4629.

3. Sustainability. An open access International journal (Indexed in Scopus, Web of Science, etc.). ISSN: 2071-1050.

4. Web site: GREEN ZOOM. <https://greenzoom.ru/>

*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](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/](https://www.yandex.ru/)
- Google search engine <https://www.google.ru/>
- Scopus abstract database <http://www.elsevierscience.ru/products/scopus/>

*The training toolkit and guidelines for a student:*

1. Collection of lectures on the course Sustainability in Civil Engineering.

\* The training toolkit and guidelines for the course 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 course Sustainability in Civil Engineering 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:**

|   |                  |                                 |
|---|------------------|---------------------------------|
| <i>associate professor</i>                  |                  | <i>S. L. Shambina</i>           |
| <hr/>                                       | <hr/>            | <hr/>                           |
| <i>position in the education department</i> | <i>signature</i> | <i>Last name and first name</i> |

**HEAD OF EDUCATIONAL  
DEPARTMENT:**

|   |                  |                                 |
|---|------------------|---------------------------------|
| <i>Head of the Department</i>               |                  | <i>Yazyev Serdar Batyrovich</i> |
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**HEAD OF EDUCATIONAL  
PROGRAMME:**

|   |                  |  |
|---|------------------|--|
| <i>associate professor</i>                  |                  | <i>Rynkovskaya Marina<br/>Igorevna</i> |
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| <i>position in the education department</i> | <i>signature</i> | <i>Last name and first name</i>        |