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

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

COURSE SYLLABUS

Problem solving tecniques in Civil Engineering
course title

Recommended by the Didactic Council for the Education Field of:
08.04.01 Civil Engineering
field of studies / speciality code and title

The course instruction is implemented within the professional education programme of higher education:
Civil Engineering and Built Environment
higher education programme profile/specialisation title

2026

1. COURSE GOAL(s)

The goal of the course Problem solving tecniques in Civil Engineering is to gain knowledge, skills, skills and experience in the field of solving scientific and technical problems in construction, taking into account and using modern materials and technologies that characterize the stages of competence formation and ensure the achievement of the planned results of the development of the educational program.

The main objectives of the course are:

• development of innovative materials, technologies, structures and systems, including using scientific achievements;

• organization and improvement of the production process at the enterprise or site, control over compliance with technological discipline, maintenance of technological equipment and machines;

• mathematical modeling of processes in structures and systems, computer methods of model implementation, development of computational methods and design automation tools;

• setting up and conducting experiments, metrological support, collection, processing and analysis of results, identification of theory and experiment;

• presentation of the results of the work performed, organization of the implementation of the results of research and practical developments;

• assessment of the technical condition of buildings, structures, their parts and engineering equipment, development of expert opinions.

2. REQUIREMENTS FOR LEARNING OUTCOMES

The course Problem solving tecniques 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 «Problem solving tecniques in Civil Engineering»

Competence code	**Competence descriptor**	**Competence formation indicators** (within this course)
GC-1	Able to critically analyze problem situations on the basis of a systematic approach, to develop a strategy of action	GC-1.1 Analyzes the problem, identifying its basic components; GC-1.2 Identifies and ranks the information required to solve the task; GC-1.3 Selects ways to solve the problem, analyzes the possible consequences of their use
GC-2	Able to manage the project at all stages of its life cycle	GC-2.1 Formulates the goals and objectives of the project, determines the expected results
GC-3	Able to organize and lead a team, developing a team strategy to achieve the goal	GC-3.1 Knows how to organize teamwork, develop a strategy to achieve the goal
GC-4	Able to use modern communication technologies in the state language of the Russian Federation and foreign language(s) for academic and professional interaction	GC-4.2 Uses modern information and communication technologies to search for information and solve standard communication tasks in Russian and foreign languages; GC-4.3 Able to present materials of academic and professional activities at public events
GC-6	Able to identify and implement the priorities of their own activities and ways to improve them on the basis of self-assessment	GC-6.1 Analyzes tasks, projects, and their goals. Defines its resources and their limits (personal, situational, temporary, etc.) for the successful completion of the task; GC-6.2 Prioritize and choose the appropriate tools and

		methods for achieving goals and managing time
GC-7	Able: to search for the necessary sources of information and data, perceive, analyze, remember and transmit information using digital means, as well as using algorithms when working with data received from various sources to effectively use the information to solve problems ; to assess information, its reliability, to build logical conclusions on the basis of incoming information and data	GC-7.1 Searches for relevant sources of information and data, perceives, analyzes, remembers and transmits information using digital tools and algorithms when working with data from various sources in order to effectively use the information to solve problems; GC-7.2 Evaluates information, its reliability, builds logical conclusions on the basis of incoming information and data
GPC-2	Able to analyze, critically comprehend and present information, search for scientific and technical information, acquire new knowledge, including with the help of information technology	GPC-2.1 Able to search for scientific and technical information, including with the help of information technology; GPC-2.2 Able to analyze, critically comprehend information, acquire new knowledge; GPC-2.3 Able to present found and meaningful information, including with the help of information technology
GPC-6	Able to carry out research of objects and processes in the field of construction and housing and communal services	GPC-6.1 Able to formulate goals, set research objectives, develop a research program; GPC-6.2 Able to choose appropriate research methods and carry out research according to the chosen methodology; GPC-6.3 Capable of processing, analyzing and drawing up research results; GPC-6.4 Able to present and defend the results of the research
GPC-7	Able to manage an organization operating in the construction industry and housing and communal services, to organize and optimize its production activities	GPC-7.5 Able to develop measures to improve the efficiency of work in the design, construction, operation of capital construction projects
PC-1	Conducting scientific research in the field of construction	PC-1.1 Able to carry out planning, preparation for research; PC-1.2 Able to carry out, control, receive research results; PC-1.3 Able to analyze and process research results; PC-1.4 Knows how to draw up, coordinate, and present the results of completed research
PC-4	Organizational and pedagogical support of students	PC-4.1 Able to carry out the development of educational and methodological documentation under the guidance of an experienced teacher; PC-4.2 Able to prepare for classes with students or monitor the knowledge of students; PC-4.3 Able to perform teaching activities according to specialized basic educational programs or additional

		education programs under the guidance of an experienced teacher

3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The course Problem solving tecniques in Civil Engineering refers to the *core 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 Problem solving tecniques 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
GC-1	Able to critically analyze problem situations on the basis of a systematic approach, to develop a strategy of action		Geoinformation Systems and Applications; Independent Research Work (obtaining basic skills of research work); Introductory Practice; Desin Practice; Technological Practice; Independent Research Work
GC-2	Able to manage the project at all stages of its life cycle		Life Cycle Economics of Buildings; BIM-Technology in Construction Management; Independent Research Work (obtaining basic skills of research work); Independent Research Work
GC-3	Able to organize and lead a team, developing a team strategy to achieve the goal		Independent Research Work (obtaining basic skills of research work); Pedagogical Practice; Independent Research Work
GC-4	Able to use modern communication technologies in the state language of the Russian Federation and foreign language(s) for academic and professional interaction		Independent Research Work (obtaining basic skills of research work); Pedagogical Practice; Independent Research Work
GC-6	Able to identify and implement the priorities of their own activities and ways to improve them on the basis of self-assessment		Life Cycle Economics of Buildings; Independent Research Work (obtaining basic skills of research work); Introductory Practice; Independent Research Work

GC-7	Able: to search for the neces-sary sources of information and data, perceive, analyze, remember and transmit information using digital means, as well as using algorithms when working with data received from various sources to effectively use the information to solve problems ; to assess information, its reliability, to build logical conclusions on the basis of incoming information and data		Geoinformation Systems and Applications; Life Cycle Economics of Buildings; BIM-Technology in Construction Management; Independent Research Work (obtaining basic skills of research work); Introductory Practice; Independent Research Work
GPC-2	Able to analyze, critically comprehend and present information, search for scientific and technical information, acquire new knowledge, including with the help of information technology		Independent Research Work (obtaining basic skills of research work); Introductory Practice; Independent Research Work
GPC-6	Able to carry out research of objects and processes in the field of construction and housing and communal services		Geoinformation Systems and Applications; Independent Research Work (obtaining basic skills of research work); Independent Research Work
GPC-7	Able to manage an organization operating in the construction industry and housing and communal services, to organize and optimize its production activities		BIM-Technology in Construction Management; Desin Practice; Technological Practice
PC-1	Conducting scientific research in the field of construction		Sustainability in Civil Engineering; Geometric Shaping and Analysis of Shells; Independent Research Work (obtaining basic skills of research work); Independent Research Work; Pre-Graduation Practice

PC-4	Organizational and pedagogical support of students		Pedagogical Practice

4. COURSE WORKLOAD

The total workload of the course Problem solving tecniques 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)**			
			1			
Contact academic hours		36	36			
including:						
Lectures (LC)		0	0			
Lab works (LW)		0	0			
Seminars (workshops / tutorials) (S)		36	36			
Self-studies academic hours		72	72			
Evaluation and assessment academic hours		0	0			
Course work / project, credits						
Course workload	academic hours	108	108			
	credits	3	3			

5. COURSE CONTENTS

Modules	**Contents (topics)**	**Academic activities types ***
Section 1. Theoretical research	Science as a continuously developing system of knowledge of the objective laws of nature, society and thinking. The purpose of science. Scientific research. Objectives of scientific research. Fundamentals of the methodology of scientific research. Theoretical research. Applied research. Technical and technological development. The purpose of the development. Scientific and technical information. Scientific direction. A scientific problem. Formulation of the problem and hypothesis. Scientific topic.	S
Section 2. Planning experiments and observations	Fundamentals of experimental research methodology. Goals and objectives of experimental research. Experiment planning. The planning matrix. Random balance method. The planning matrix. Random balance method. Construction of interpolation models. Optimization of processes (planning of extreme experiments). Regression analysis. Factorial experiment.	S
Section 3.	Natural experiments. Artificial experiments.	S

Modules	Contents (topics)	Academic activities types *
Experimental studies	Computational experiments. Laboratory experiment. A full-scale experiment. Research (search) experiment. Confirming experiment. Design of the methodology and selection of equipment. Preparation of samples and elements. Development of a variable control plan. Conducting an experiment. Processing and interpretation of the results. Preparation of a scientific report.	
Section 4. Processing and analysis of research results	Comparison of the results of theoretical and experimental studies. Comparison criteria. Criteria for the adequacy of theoretical dependencies to experimental ones. Mathematical processing of experimental data. Analysis of the results of experimental studies. Preparation of research results for publication and scientific periodicals. Scientific and technical report. Report.	S

* - 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)
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	A classroom for conducting classes, group and individual consultations, current and mid-term assessment, equipped with personal computers (in the amount of 22 pcs), a board (screen) and technical means of multimedia presentations.	Software: PowerPoint
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. Kennett B. Planning and Managing Scientific Research [Electronic resource] 2014. 1 p. ISBN 9781925021585 URL: http://www.oapen.org/download/?type=document&docid=477381

Additional readings:

1. Thompson, C. Bertrand. The theory and practice of scientific management / by C. Bertrand Thompson [Electronic resource] 319 p. URL: http://dlib.rsl.ru/rsl01004000000/rsl01004440000/rsl01004440823/rsl01004440823.pdf
2. H. Morrow, Richard, G. Smith, Peter, A. Ross, David. Methods of analysis [Electronic resource] 2024. 1 p. ISBN 9780198732860
URL: http://www.oapen.org/view?docId=1000074.nxml
3. Brugnano L., Iavernaro F. Advanced Numerical Methods in Applied Sciences [Electronic resource] 2019. 1 p. ISBN 9783038976660
URL: https://mdpi.com/books/pdfview/book/1360
4. H. Morrow, Richard, G. Smith, Peter, A. Ross, David. Field laboratory methods [Electronic resource] 2015. 1 p. ISBN 9780198732860
URL: http://www.oapen.org/view?docId=1000078.nxml
5. Jevons W. S. The principles of science :. a treat on logic and scientific method / by W. Stanley Jevons [Electronic resource]. - London : Macmillan, 1879. URL: http://dlib.rsl.ru/rsl01004000000/rsl01004427000/rsl01004427845/rsl01004427845.pdf

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"
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/

The training toolkit and guidelines for a student:

1. Collection of lectures on the course Problem solving tecniques 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 Problem solving tecniques 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:

assistant		*Baza T.T.*
position in the education department	*signature*	*Last name and first name*

HEAD OF EDUCATIONAL DEPARTMENT:

Head of the Department		*Yazyev Serdar Batyrovich*
position in the education department	*signature*	*Last name and first name*

HEAD OF EDUCATIONAL PROGRAMME:

associate professor		*Rynkovskaya Marina Igorevna*
position in the education department	*signature*	*Last name and first name*