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

Digital technologies in construction

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

2024

1. COURSE GOAL(s)

The goal of the course <u>Digital technologies in construction</u> is to provide students with the skills and knowledge of digital technologies currently employed in the planning, design, construction and operations of the built environment.

Course objectives:
- To provide knowledge of emerging digital technologies and their potential application to building projects.
- To establish an understanding of the Building Information Modelling (BIM) concept, its technologies and processes, and its application throughout the building lifecycle.
- To provide practical skills in the use of Building Information Modelling (BIM) software package.

2. REQUIREMENTS FOR LEARNING OUTCOMES

The course <u>Digital technologies in construction</u> 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 <u>«Digital technologies in construction»</u>

Competence code	Competence descriptor	Competence formation indicators (within this course)
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	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-1	Able to solve problems of professional activity on the basis of theoretical and prac-tical foundations, the math-ematical apparatus of the fundamental sciences	GPC-1.3 Solves professional problems using modern software systems for mathematical, digital modeling of structures
GPC-3	Able to set and solve scientific and technical problems in the field of construction, construction industry and housing and communal services on the basis of knowledge of industry problems and experience in their solution	GPC-3.1 Able to formulate and solve scientific and technical tasks in the field of building structures design; GPC-3.3 Able to formulate and solve scientific and technical tasks in the field of engineering systems design
GPC-4	Able to use and develop project and administrative documentation, as well as participate in the development of normative legal acts in the field of construction and housing and	GPC-4.1 Able to use and develop project documentation; GPC-4.3 Able to use normative legal acts in the field of construction industry and housing and communal services, as well as to participate in their development

	communal services		
GPC-5	Able to conduct and organize design and survey work in the field of construction, housing and communal services, carry out technical expertise of projects and designer's supervision of their compliance	GPC-5.1 Able to conduct and organize survey work in the field of construction and housing and communal services; GPC-5.2 Capable of conducting and organizing technical expertise of projects and author's supervision of their observance	
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; PC-2.2 Able to perform engineering and technical design and develop design products for engineering systems and engineering structures	

3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The course Digital technologies in construction 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 Digital technologies in construction.

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-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-1	Able to solve problems of professional activity on the basis of theoretical and prac-tical foundations, the math-ematical		Independent Research Work (obtaining basic skills of research work); Desin Practice; Independent Research Work

	apparatus of the fundamental sciences		
GPC-3	Able to set and solve scientific and technical problems in the field of construction, construction industry and housing and communal services on the basis of knowledge of industry problems and experience in their solution		BIM-Technology in Construction Management; Independent Research Work (obtaining basic skills of research work); Desin Practice; Technological Practice; Independent Research Work
GPC-4	Able to use and develop project and administrative documentation, as well as participate in the development of normative legal acts in the field of construction and housing and communal services		Life Cycle Economics of Buildings; BIM-Technology in Construction Management; Desin Practice; Technological Practice
GPC-5	Able to conduct and organize design and survey work in the field of construction, housing and communal services, carry out technical expertise of projects and designer's supervision of their compliance		Life Cycle Economics of Buildings; BIM-Technology in Construction Management; Desin Practice; Technological Practice
PC-2	Development of project products based on the results of engineering and technical design for urban development activities		Life Cycle Economics of Buildings; Structural Design in Reinforced Concrete: Special Topics; Structural Dynamics; Structural Design in Steel: Special Topics; Modelling of Construction Processes; Applications of Finite Element Method for Civil Engineering problems; Sustainability in Civil Engineering; Optimization Methods in Civil Engineering; Structural Stability; Geometric Shaping and

				Analysis of Shells; Engineering Systems of Buildings; Desin Practice; Technological Practice; Pre-Graduation Practice

4. COURSE WORKLOAD

The total workload of the course <u>Digital technologies in construction</u> is <u>4</u> 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)		36	36				
Seminars (workshops / tutorials) (S)		0	0				
Self-studies academic hours		81	81				
Evaluation and assessment academic hours		27	27				
Course work / project, credits							
Course workload	academic hours	144	144				
	credits	4	4				

5. COURSE CONTENTS

Modules	Contents (topics)	Academic activities types *
Section 1. BIM Technology	Introduction to BIM process and integrated project delivery. ND modelling. BIM software systems and guidelines to choosing different BIM software systems	LW
Section 2. Basic Modelling	Introduction of modelling environment and tools. Modelling approaches to producing plans, 3D models, views and sections of buildings. Modelling of building including basic and vital elements, production of plans, views and 3D models.	LW
Section 3. Advance Concepts	Model customizations, elements and materials. Creation of internal components, external elements, massing and site modelling. Elements visibility, visualization and walkthroughs	LW
Section 4. Virtual and Augmented Reality	Virtual Reality vs. Augmented Reality. Applications of AR/VR in construction	LW

* - 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)
Lab works	An auditorium for laboratory work, equipped with a set of specialized furniture and equipment.	Computer laboratory
Computer Labs	A classroom for conducting classes, group and individual consultations, current and mid-term assessment, equipped with personal computers (in the amount of 14 pcs), a board (screen) and technical means of multimedia presentations.	Software: Revit, Renga
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. BIM and Construction Management: Proven Tools, Methods, and Workflows, Brad Hardin, Dave McCool, John Wiley & Sons, 2023.

2. BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors, Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston, Wiley, 2016.

3. Building Information Modeling: Planning and Managing Construction Projects with 4D CAD and Simulations, McGraw Hill Professional, Kymmell, Willem, 2018.

Additional readings:

1. Talapov, VV BIM technology: the essence and features of the implementation of information modeling of buildings / VV Talapov. Moscow: DMK-Press, 2016.- 410 p.

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 Digital technologies in construction.

* 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 <u>Digital technologies in construction</u> 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:

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    position, educational department   signature   name and surname

_____   _____   _____
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