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

VR and AR Technologies in Civil Engineering: Special Topics
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

2025

1. COURSE GOAL

The goal of the course is to obtain knowledge, skills, abilities and experience in the field of VR and AR technologies, necessary for the formation of competencies and ensuring the achievement of the planned results of the educational program.

2. REQUIREMENTS FOR LEARNING OUTCOMES

The course 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

Competence code	**Competence descriptor**	**Competence formation indicators** (within this course)
PC-1	Conducting scientific research in the field of construction	PC-1.4 Able to formalize, coordinate, and present the results of completed research
PC-5	Organization of construction work at a capital construction site	PC-5.5 Capable of carrying out technical control, supervision, acceptance of construction works

3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The course refers to the *elective component* of (B1) block of the higher educational programme curriculum. Within the higher education program students also master other disciplines (modules) and / or internships that contribute to the achievement of the expected learning outcomes as results of the course.

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 tecniques in Civil Engineering	Geometric Shaping and Analysis of Shells
PC-5	Organization of construction work at a capital construction site	Modelling of Construction Processes	BIM-Technology in Construction Management

4. COURSE WORKLOAD

The total workload of the course is 2 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		54	54			
including:						
Lectures (LC)		18	18			
Lab works (LW)		0	0			
Seminars (workshops / tutorials) (S)		18	18			
Self-studies academic hours		18	18			
Evaluation and assessment academic hours		18	18			
Course workload	academic hours	72	72			

Type of academic activities		Total academic hours	Semester(s)			
			3			
	credits	2	2			

5. COURSE CONTENTS

Modules	Contents (topics)	Academic activities types *
Section 1. Concepts of VR and AR technologies	Topic 1.1 Concept and technologies of virtual reality. History of virtual reality. Main goals and objectives of VR and AR technologies Topic 1.2 Virtual reality and BIM. Application of virtual reality tools in design and construction Topic 1.3 Means of immersion in virtual reality. Evolution of VR devices	LC
Section 2. Concepts of Virtual Reality and BIM	Topic 2.1 Software packages for VR and AR. VR Concept program interface. Topic 2.2 Connection between VR and design software - Autodesk Revit Topic 2.3 Exporting a model to a VR environment	LC, S
Section 3. Working with the model in VR: in-depth analysis	Topic 3.1 Working with scene and view Topic 3.2 Technology of assembly and disassembly of elements	LC, S
Section 4. Creating animation in VR	Topic 4.1 Creating and viewing assembly/disassembly animations in virtual reality	LC, 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)
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 computer room for conducting classes, group and individual consultations, ongoing monitoring and midterm assessment, equipped with personal computers (14 in total), a board (screen) and technical means for multimedia presentations.	VR Concept Autodesk 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. Smolin A.A., Zhdanov D.D., Potemin I.S., Mezhenin A.V., Bogatyrev V.A. Virtual, Augmented, and Mixed Reality Systems A Tutorial.
– Saint Petersburg: ITMO University. 2018 . – 59 p.
2. Chapman, Nigel. Digital Multimedia Technologies / Nigel Chapman, Jenny Chapman ; [translated from English by I. Yu. Doroshenko, A. V. Nazarenko edited by A. V. Nazarenko] .- 2nd ed. - Moscow ; Saint Petersburg ; Kyiv : Williams, 2006 .- 624 p. : ill. ; 24 cm .-
Glossary of terms: pp. 595-617. Index: pp. 618-623. - Per. ed.: Digital Multimedia / N. Chapman, J. Chapman. Chichester, 2004. - ISBN 5-8459-0888-4. - ISBN 0-470-85890-7.

Additional readings:

1. Talapov, Foreman N., Korallo L. The Past and Future of 3D Virtual Reality Technologies. Scientific and Technical Bulletin of ITMO. November-December 2014. [Electronic resource]. Access mode http://ntv.ifmo.ru/ru/article/11182/proshloe_i_buduschee_3-D_tehnologiy_virtualnoy_realnosti.ht

Internet sources:

1. Virtual reality. Unified collection of digital educational resources 2017 [Electronic resource]. Access mode http://files.school-collection.edu.ru/dlrstore/39131517-5991-11da-8314-0800200c9a66/index.htm
2. https://vrconcept.net/.
3. Virtual reality (VR): past, present and future 2017 [Electronic resource]. Access mode http://vrmania.ru/stati/virtualnaya-realnost.html
4. 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"
5. 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 Structural Dynamics.

* 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 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 in the education department	*signature*	*Last name and first name*

HEAD OF EDUCATIONAL DEPARTMENT:

Head of the Department		*Yazyev Serdar Batyrovich*
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