

*Federal State Autonomous Educational Institution of Higher Education
"Peoples' Friendship University of Russia"*

*Academy of Engineering
(faculty / institute / academy)*

Recommended by ISSC

THE WORKING PROGRAM OF THE DISCIPLINE

Name of the discipline Building designs, buildings and constructions: the theory of buildings and structures

Recommended for the direction of training / specialty

08.06.01 Technique and technology of construction/ Техника и технологии строительства
(the code and name of the direction of training / specialty are indicated)

Focus of the program (profile)

05.23.17. Structural mechanics

(name of the educational program in accordance with the direction (profile))

1. Goals and objectives of the discipline: Building designs, buildings and constructions: the theory of buildings and structures

The **purpose** of mastering the discipline Building designs, buildings and constructions: the theory of buildings and structures is the acquisition of knowledge, abilities, skills and experience in the field of theory and design of buildings and structures that characterize the stages of the formation of competencies and ensure the achievement of the planned results of the development of the educational program.

The **main objectives** of the discipline are:

- training of specialists of a wide profile in industrial and civil construction with in-depth study of the basics of design, manufacture, installation, strengthening of building structures of buildings and structures;
- formation of skills in calculations and design of specific engineering problems using design norms, standards, reference books;
- the use of automation tools for the design of building structures.

2. Place of discipline in the structure of EP HE:

The discipline Building designs, buildings and constructions: the theory of buildings and structures refers to the variable part of block 1 of the curriculum.

Table 1 shows the previous and subsequent disciplines aimed at the formation of discipline competencies in accordance with the competence matrix of EP HE.

Table No. 1

Prior and subsequent disciplines aimed at the formation of competencies

No	Code and name of competence	Preceding disciplines	Subsequent disciplines (groups of disciplines)
General cultural competences			
General professional competencies			
	GPC-1	Methodology of Scientific Research.	Advanced Structural Mechanics Analysis and Design of Structural Systems Technology and Organization of Construction Scientific Research State Exam PhD Qualification Thesis and Presentation
	GPC-2	Methodology of Scientific Research. Scientific Seminar Scientific Research	Advanced Structural Mechanics Analysis and Design of Structural Systems Technology and Organization of Construction Scientific Research State Exam PhD Qualification Thesis and Presentation .
Professional competencies (type of professional activity of a builder)			
	PC-1	Methodology of Scientific Research	Advanced Structural Mechanics Analysis and Design of

		Scientific Seminar Scientific Research	Structural Systems Technology and Organization of Construction Practice in Obtaining Professional Skills and Professional Experience (Research Practice)Scientific Research Scientific Research 2 State Exam PhD Qualification Thesis and Presentation
Vocational and specialized competency specialization Structural Mechanics			

3. Requirements for the results of mastering the discipline:

The process of studying the discipline «Building designs, buildings and constructions: the theory of buildings and structures» is aimed at developing the following competencies:

- possession of the methodology of theoretical and experimental research in the field of construction (GPC-1);
- possession of the culture of scientific research in the field of construction, including the use of the latest information and communication technologies (GPC-2);
- possession of methods for the development of scientific and methodological foundations of research, improvement, theoretical, experimental and feasibility studies for the use of various technical solutions and technologies in construction (PC-1).

As a result of studying the discipline, the student must:

Know: the methodology of theoretical and experimental research in the field of construction; the culture of scientific research in the field of construction, including the use of the latest information and communication technologies; methods of developing scientific and methodological foundations for research, improvement, theoretical, experimental and feasibility studies for the use of various technical solutions and technologies in construction.

Be able to: carry out theoretical and experimental research in the field of construction; conduct scientific research in the field of construction, including using the latest information and communication technologies; development of scientific and methodological foundations for research, improvement, theoretical, experimental and feasibility studies for the use of various technical solutions and technologies in construction; to carry out scientific substantiation of methods for achieving competitive building technologies and organizational and technological solutions in construction.

Own: the methodology of theoretical and experimental research in the field of construction; skills in conducting scientific research in the field of construction, including using the latest information and communication technologies; innovative scientifically grounded methods of design of structures and technological solutions in construction.

4. The scope of the discipline and types of educational work

The total workload of the discipline is 3 credit points.

Type of educational work	Total hours	Semesters			
		4			

Classroom lessons (total)	52	52			
Including:	-	-	-	-	-
<i>Lectures</i>	18	18			
<i>Practical lessons (PL)</i>	38	38			
<i>Seminars (S)</i>	0	0			
<i>Laboratory work (LW)</i>	0	0			
Independent work (total)	34	34			
Total labor intensity	hours	108			
	credits	3			

5. Discipline content

5.1. Contents of discipline sections

№	The name of the discipline section	Section content (topics)
1.	Special topics in the design of metal structures	<ul style="list-style-type: none"> - Classification of buildings by structural systems. Multi-storey and high-rise buildings with a metal frame. - Composite frames: decks, beams, columns, foundations. Ensuring the spatial rigidity of frame buildings. Vertical and horizontal connections of the building. - Determination of the loads acting on the building. Methods for the analysis of structural systems. Frames of multi-storey buildings. Accounting for the plastic work of the material. - Design of light metal structures: light beams, light trusses and frames. Lightweight structural metal shells.
2.	Special topics in the design of reinforced concrete structures	<ul style="list-style-type: none"> - Construction of multi-storey industrial buildings. Purpose of the building. Sizing. Number of floors. Column grid. Main supporting structures. - Multi-storey prefabricated frame. Constructive schemes of multi-storey frames with ready-made elements. Connections of multi-storey prefabricated frames. - Multi-storey monolithic and prefabricated monolithic construction. Units of monolithic multi-storey frames. Rebar nodes. - Practical calculation of multi-storey frames. Preselection of sections of frame elements. Computer simulation of RC frames.
3.	Reliability and safety of buildings and structures	<ul style="list-style-type: none"> - Reliability as the ability of a building or structure to perform its functions. Service life of construction projects. Operating conditions of building structures. Durability of buildings as the ability of structures to maintain their properties. <ul style="list-style-type: none"> - Operation of buildings and structures. Maintenance of building structures. Repair and reinforcement of structures or reconstruction of a building. Technical monitoring of buildings and structures. - The probabilistic nature of the loads and mechanical properties of building materials. System security factors. Calculation of limit states. - Criteria for the reliability of buildings and structures. Application of the principle of structure analysis for the most unfavorable combination of loads. The choice of materials for structures that increase their reliability. - Adoption of design and engineering decisions that reduce the

		likelihood of progressive collapse. Selection of optimal technological processes for the manufacture of structures and effective methods of construction of buildings and structures.
4.	Design of earthquake-resistant structures.	<ul style="list-style-type: none"> - Occurrence and consequences of earthquakes; Seismological foundations of earthquake-resistant construction; Propagation of waves caused by earthquakes. - Determination of parameters that determine the impact of earthquakes; Methods for calculating soil interaction; Design and analysis of plastic structures to maintain performance and / or safety. - Active and passive methods for identifying structures from earthquakes; Determination of the size of soil structures for earthquakes; Examples from engineering practice.

5.2 Sections of disciplines and types of classes

№	The name of the discipline section	Lekts.	Pract. work	Lab. work	Semin	IWS	Total hour.
1.	Special topics in the design of metal structures	5	10			9	24
2.	Special topics in the design of reinforced concrete structures	5	10			9	24
3.	Reliability and safety of buildings and structures	4	9			8	21
4.	Design of earthquake-resistant structures.	4	9			8	21

6. Laboratory workshop

No laboratory workshop provided

7. Practical lessons

№	Discipline section number	Topics of Practical lessons (seminars)	Labor capacity (hour.)
1.	1	<p>Multi-storey and high-rise buildings with a metal frame. Composite frames: decks, beams, columns, foundations. Ensuring the spatial rigidity of frame buildings. Vertical and horizontal connections of the building. Determination of the loads acting on the building. Study of methods for the analysis of structural systems. Frames of multi-storey buildings. Accounting for the plastic work of the material. Design of light metal structures: light beams, light trusses and frames. Lightweight structural metal shells.</p>	2 2 2 2 2
2.	2	<p>The main approaches to the construction of multi-storey industrial buildings. Purpose of the building. Sizing. Number of floors. Column grid. Main supporting structures. Multi-storey prefabricated frame. Constructive schemes of multi-storey frames with ready-made elements. Connections of multi-storey prefabricated frames. Multi-storey monolithic and prefabricated monolithic construction. Units of monolithic multi-storey frames. Rebar</p>	2 2 2

		nodes. Practical calculation of multi-storey frames. Preselection of sections of frame elements. Computer simulation of RC frames.	2 2
3.	3	Determining the service life of construction projects. Operating conditions of building structures. Durability of buildings as the ability of structures to maintain their properties. Operation of buildings and structures. Maintenance of building structures. Repair and reinforcement of structures or reconstruction of a building. Technical monitoring of buildings and structures. Probabilistic nature of loads and mechanical properties of building materials. System security factors. Calculation of limit states. Criteria for the reliability of buildings and structures. Application of the principle of structure analysis for the most unfavorable combination of loads. The choice of materials for structures that increase their reliability. - Adoption of design and engineering decisions that reduce the likelihood of progressive collapse. Selection of optimal technological processes for the manufacture of structures and effective methods of construction of buildings and structures.	2 2 2 2 1
4.	4	Study of the causes and consequences of earthquakes. Study of the seismological foundations of earthquake-resistant construction. Propagation of waves caused by earthquakes. Determination of the parameters that determine the impact of earthquakes. Study of methods for calculating the interaction of soil. Design and analysis of plastic structures to maintain performance and / or safety. Study of active and passive methods for identifying structures from earthquakes. Determination of the size of soil structures for earthquakes. Examples from engineering practice.	2 2 2 2 1

8. Material and technical support of the discipline:

Lecture room - Specialized room number 298 - "Modeling of large-span building structures"

Equipment and furniture:

- a set of specialized furniture;
- chalk board;
- projection screen;
- multimedia projector EPSON EMP-X5.

Classroom for practical exercises, monitoring and intermediate certification - Computer class № 352 Laboratory of Hydrological and Technical Safety of Hydraulic Structures.

Equipment and furniture:

- a set of specialized furniture;
- chalk board;
- interactive whiteboard PolyVision Webster TSL 610;
- Toshiba TLP XC3000 multimedia projector;
- roll-up wall screen Draper Luma 178x178;

- Pirit Codex 1226 computer - 1 pc .;
- sound amplifying equipment GENIUS SP-i350 - 1 piece;
- Xerox 3125 printer - 1 pc .;
- Scanner Epson 10V Photo - 1 pc .;
- plotter HP DesignJet 130+ NR (A1) - 1 pc .;
- Pirit Doctrina computers - 9 pcs .;
- LCD ViewSonic 22 "VA2216w monitor - 9 pcs .;
- 19 "NEC monitor - 1 pc.

(RUDN University software: Plaxis 2D Suit (Network license). Plaxis Professional (version 8) + Plaxis Dynamics Modul + PlaxFlow (version 1) - Education Registration number 90-07-019-00261-3

MS-office corporate, Registration code: 86626883

Parent program: 86493330

Status: Active).

9. Information support of the discipline

a) software

The use of specialized software in the study of the discipline is not provided.

б) databases, reference and search systems

- EBS of RUDN University and third-party EBS to which university students have access on the basis of concluded agreements:

- RUDN University Electronic Library System - RUDN University Library System

<http://lib.rudn.ru/MegaPro/Web>

- EBS "University Library Online" <http://www.biblioclub.ru>

- EBS Yurayt <http://www.biblio-online.ru>

- EBS "Student Consultant" www.studentlibrary.ru

- EBS "Doe" <http://e.lanbook.com/>

2. Websites of ministries, departments, services, manufacturing enterprises and companies whose activities are core to this discipline:

Ministry of Construction of Russia <http://www.minstroyrf.ru>

3. Databases and search engines:

- electronic fund 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/>

10. Educational and methodological support of the discipline:

a) Main literature

1. Yudina, AF Metallicheskie i zhelezobetonnye konstruktsiy [Metal and reinforced concrete structures]. Editing: textbook for universities / A.F. Yudin. - 2nd ed., Rev. and add. - Moscow: Yurayt Publishing House, 2019 .-- 302 p. - (Series: Specialist). - ISBN 978-5-534-06927-3. - Text: electronic // EBS Yurayt [site]. - URL: <https://biblio-online.ru/bcode/434494> (date of access: 01.04.2019).

2. Krivoshapko, SN Architectural and building structures: a textbook for academic bachelor's degree / SN Krivoshapko, VV Galishnikova. - Moscow: Yurayt Publishing House, 2019 .-- 460 p. - (Series: Bachelor. Academic course). - ISBN 978-5-534-03143-0. - Access mode: HYPERLINK <https://biblio-online.ru/bcode/432798>

3. Tukhfatullin, BA Numerical methods of calculation of building structures. Finite element method: textbook. manual for academic bachelor's degree / BA Tukhfatullin. - 2nd ed., Rev. and add. - Moscow: Yurayt Publishing House, 2019 .-- 157 p. - (Series: Bachelor. Academic course). - ISBN 978-5-534-08899-1. - Access mode: HYPERLINK <https://biblio-online.ru/bcode/442338>

6) additional literature

1. Krivoshapko, SN Construction of buildings and structures: textbook for SPO / SN Krivoshapko, VV Galishnikova. - Moscow: Yurayt Publishing House, 2019 .-- 476 p. - (Series: Professional Education). - ISBN 978-5-534-02348-0. - Access mode: HYPERLINK <https://biblio-online.ru/bcode/433396>

2. Dedyukh, RI Materials science and technology of structural materials. Fusion welding technology: textbook. manual for applied baccalaureate / RI Dedyukh. - Moscow: Yurayt Publishing House, 2019 .-- 169 p. - (Series: Universities of Russia). - ISBN 978-5-534-01539-3. - Text: electronic // EBS Yurayt [site]. - URL: <https://biblio-online.ru/bcode/433979> (date of access: 01.04.2019).

3. Yudina, AF Building structures. Editing: textbook for SPO / A.F. Yudin. - 2nd ed., Rev. and add. - Moscow: Yurayt Publishing House, 2019 .-- 302 p. - (Series: Professional Education). - ISBN 978-5-534-07027-9. - Access mode: HYPERLINK <https://biblio-online.ru/bcode/442133>

4. Shambina S.L. Structural mechanics [Text / electronic resource]: Lecture notes. / S.L. Shambina. - Electronic text data. - M.: Publishing house of RUDN, 2015 .-- 48 p. : ill. - ISBN 978-5-209-06779-5: 42.15. Access mode: http://lib.rudn.ru/MegaPro/UserEntry?Action=Rudn_FindDoc&id=447028&idb=0

11. Methodical instructions for students on mastering the discipline (module)

1. A course of lectures on the discipline "Building designs, buildings and constructions: the theory of buildings and structures" (Appendix 2).

2. Methodical instructions for independent work of students in the discipline "Building structures, buildings and structures" (Appendix 3).

12. Fund of assessment tools for intermediate certification of students by discipline (module)

The fund of assessment tools, formed for the current monitoring of progress and intermediate certification of students in the discipline "Building designs, buildings and constructions: the theory of buildings and structures" is presented in Appendix 1 to the work program of the discipline and includes:

- a list of competencies formed in the course of studying the discipline;
- description of indicators and criteria for assessing competencies, description of assessment scales;
- typical control tasks or other materials necessary to assess knowledge, skills, abilities and (or) experience of activities, characterizing the level of competence formation;
- methodological materials defining the procedures for assessing knowledge, skills, skills and (or) experience of activities, characterizing the level of competence formation.

The materials are developed in full and are available for students on the discipline page at the TUIS RUDN University.

The program has been drawn up in accordance with the requirements of the ES of HE RUDN University.

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