

*Федеральное государственное автономное образовательное учреждение  
высшего образования  
«Российский университет дружбы народов»*

*Инженерная академия*

**ПРОГРАММА  
ГОСУДАРСТВЕННОЙ ИТОГОВОЙ АТТЕСТАЦИИ**

**Направление подготовки:** 08.04.01 Civil Engineering/ Строительство

**Направленность (профиль/специализация):** Civil Engineering and Built Environment /  
Строительная инженерия и построенная среда (англ.)

Built Environment of Smart City / Городская среда Умного города (англ.)

Mechanics of Materials and Engineering Structures / Механика материалов и инженерных кон-  
струкций (англ.)

## **1. The purpose and objectives of the state final certification**

The state final certification (hereinafter referred to as the GIA) is conducted by state examination commissions (hereinafter referred to as the GEC) in order to determine the compliance of the results of mastering the basic educational program Civil Engineering/ Construction by students with the requirements of the educational standard of the RUDN, approved by the Rector's Order No. 831 of 11.11.2016.

The main objectives of the GIA are:

- completion of the formation and determination of the student's level of formation of competencies provided for by the educational standard of the RUDN in the direction 08.04.01 Civil Engineering/ Construction (universal, general professional and professional);
- defined by the educational standard of the RUDN in accordance with the type/types of professional activities that the educational program is focused on;
- making a decision of the SES on awarding the "master" qualification to a student who has fully mastered the educational program.

## **2. Forms and place of GIA in the structure of the educational program**

The state final certification refers to the basic part of Block 3 of the curriculum.

The state final certification according to the educational program Civil Engineering and Built Environment / Строительная инженерия и построенная среда (англ.), Built Environment of Smart City / Городская среда Умного города (англ.), Mechanics of Materials and Engineering Structures / Механика материалов и инженерных конструкций (англ.) in the direction 08.04.01 Civil Engineering / Construction is carried out in the form of preparation for passing and passing the state exam, as well as the presentation of a scientific report on the main results of the prepared scientific qualification work (dissertation).

## **3. Перечень планируемых результатов освоения образовательной программы**

As a result of mastering the educational program Civil Engineering and Built Environment / Строительная инженерия и построенная среда (англ.), Built Environment of Smart City / Городская среда Умного города (англ.), Mechanics of Materials and Engineering Structures / Механика материалов и инженерных конструкций (англ.) in the direction 08.04.01 Civil Engineering / Construction, the graduate must have the following universal, general professional and professional competencies:

Universal competencies:

УК-1. He is able to carry out a search, critical analysis of problem situations based on a systematic approach, develop a strategy of actions.

УК -2. He is able to manage the project at all stages of its life cycle.

УК -3. He is able to organize and manage the work of the team, developing a command strategy to achieve the set goal.

УК -4. Is able to apply modern communication technologies in the state language of the Russian Federation and a foreign language (s) for academic and professional interaction.

УК -5. It is able to analyze and take into account the diversity of cultures in the process of inter-cultural interaction.

УК -6. He is able to determine and implement the priorities of his own activities and ways to improve it on the basis of self-assessment.

YK -7. It is 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 obtained from various sources in order to effectively use the information received for solving problems; evaluate information, its reliability, build logical conclusions based on incoming information and data.

A graduate of the Master's program must have the following general professional competencies (ОПК):

ОПК-1. He is able to solve the problems of professional activity on the basis of the use of theoretical and practical foundations, the mathematical apparatus of fundamental sciences

ОПК-2. He is able to analyze, critically comprehend and present information, search for scientific and technical information, acquire new knowledge, including with the help of information technologies

ОПК-3. He is able to set and solve scientific and technical problems in the field of construction, the construction industry and housing and communal services on the basis of knowledge of the problems of the industry and experience in solving them

ОПК-4. He is able to use and develop project and administrative documentation, as well as participate in the development of regulatory legal acts in the field of the construction industry and housing and communal services

ОПК-5. He is able to conduct and organize design and survey work in the field of construction and housing and communal services, carry out technical expertise of projects and author's supervision of their compliance

ОПК-6. It is able to carry out research of objects and processes in the field of construction and housing and communal services

ОПК-7. He is able to manage an organization operating in the construction industry and housing and communal services, organize and optimize its production activities

The graduate of the program must have professional competencies (PC) corresponding to the type (types) of professional activity that the master's program is focused on:

Conducting applied research in the field of engineering and technical design for urban planning (PC-1);

Development of design products based on the results of engineering and technical design for urban planning activities (PC-2);

Provision of technical operation of civil buildings (PC-3);

Management of the complex of works on the operation and repair of civil buildings (PC-4);

Organization of construction works at the capital construction facility (PK-5);

Organizational, technical and technological preparation of construction production (PC-6);

Management of production, technical and technological support of construction production (PC-7);

Determination of the cost of construction and installation works performed by a construction organization (PC-8);

Providing economic planning and accounting in construction (PC-9);

Organization of the preparatory process for the development of documentation necessary for the performance of construction and installation works (PC-10);

Preparation of the section of project documentation for building structures of buildings and structures (PC-11);

Study of the object of urban planning activity to obtain information about the state and predicted properties of the foundation, foundation structures and underground structures (PC-12);

Preparation of project documentation for water supply and sanitation systems for capital construction projects (PC-13);

Design of systems of internal heat supply, heating, ventilation, air conditioning, air heating, smoke removal (PC-14);

Organization of general construction works during the construction, operation and reconstruction of hydraulic structures and reclamation systems (PK-15);

Organizational and pedagogical support of students (PC-16).

#### 4. Объем ГИА и виды учебной работы

The state final certification is carried out in the form of contact work and in the form of independent work of students (table 1).

Table 1-The volume of GIA and types of educational work

Вид учебной работы		Всего, ак. часов	Семестр
			4
<b>Подготовка и сдача государственного экзамена</b>			
Контактная работа обучающегося с преподавателем		4	4
Самостоятельная работа обучающегося, включая сдачу экзамена		104	104
Вид аттестационного испытания		экзамен	
Общая трудоемкость аттестационного испытания	академических часов	108	108
	зачетных единиц	3	3
<b>Подготовка к процедуре защиты и защита выпускной квалификационной работы (ВКР)</b>			
Контактная работа обучающегося с преподавателем		8	8
Самостоятельная работа обучающегося, включая защиту ВКР		208	208
Вид аттестационного испытания		публичная защита	
Общая трудоемкость аттестационного испытания	академических часов	216	216
	зачетных единиц	6	6
<b>Общая трудоемкость ГИА</b>	академических часов	<b>324</b>	<b>324</b>
	зачетных единиц	<b>9</b>	<b>9</b>

#### 5. State exam Program

The state exam on the educational program Civil Engineering and Built Environment / Строительная инженерия и построенная среда (англ.), Built Environment of Smart City / Городская среда Умного города (англ.), Mechanics of Materials and Engineering Structures / Механика материалов и инженерных конструкций (англ.) in the direction of 08.04.01 Civil Engineering/Construction is carried out in two stages:

- stage one-computer testing (test part);
- stage two – the main part.

The purpose of the test part of the state exam is to assess the level of theoretical preparation of the graduate according to the material of the disciplines/modules of the educational program. The test task contains 20 questions. The student is given 40 minutes to complete the test task.

The main part of the state exam is conducted in writing using examination tickets. Each exam ticket contains four questions and a task.

The questions and tasks included in the examination ticket are of an inter-disciplinary nature and are aimed at determining the level of theoretical and practical readiness of the graduate to solve professional tasks defined by the educational standard of the RUDN in accordance with the type/types of professional activity that the educational program is focused on.

The total number of examination tickets is determined by the number of students admitted to the state exam. The student is given 90 minutes to prepare and defend a written response on the ticket.

At the state exam, the members of the GEC can ask the student additional questions in the field of professional activity of the graduate, provided for by the educational standard.

The list of questions for preparing for the state exam, as well as the criteria for evaluating the results of this stage of the state final certification are provided in the GIA evaluation funds fund.

## **6. Requirements for the WRC and the procedure for its implementation**

The final qualification work is the work performed by the student, demonstrating the level of his readiness for independent professional activity.

The general requirements for the content, structure and design of the WRC, as well as the procedure for its protection, are regulated by the relevant local regulatory and administrative acts of the RUDN and/or the Engineering Academy, which are listed in paragraph 7 of this Program.

The defense of the WRC can be conducted in a foreign language (in accordance with the current Regulations).

## **7. Normative and educational-methodological support of the GIA**

1. Federal Law " On Education in the Russian Federation " dated 29.12.2012 No. 273-FZ.

2. The procedure for organizing and implementing educational activities for educational programs of higher education – bachelor's degree programs, specialty programs, master's programs, approved by Order of the Ministry of Education and Science of the Russian Federation No. 301 of April 5, 2017.

3. The procedure for the state final examination in the educational programmes of higher education – undergraduate, programs, experts calitate and master's degree programs approved by the Ministry of education and science of the Russian Federation dated June 29, 2015 No. 636.

4. The procedure for the implementation of educational activities on educational programs of higher education – undergraduate, programme specialist of Licata and master's degree programs at the Russian University of friendship of peoples, approved by Order of the rector of 12.03.2018, No. 171.

5. The procedure for the final state certification of students in programs of higher education – undergraduate, programme specialist of Licata and master's degree programs at the Russian University of friendship of peoples (new edition), approved by Order of the rector of 13.10.2016, No. 790.

6. Rules for the preparation and registration of final qualifying work of the graduate of the Russian University of friendship of peoples, approved by the rector's Order dated 30.11.2016, No. 878.

7. The regulations of the state certification of educational Programs of higher education – undergraduate, programs specialite and master's degree programs to study, approved by the rector's Order dated 14.12.2015, No. 768.

8. The order of the rector of 11.02.2015 № 65 "On compulsory study of foreign languages and the protection of the WRC in foreign languages in the magistracy."

9. Regulations for individual consultations to prepare students for the protection of the WRC in a foreign language and the implementation of procedures for oral protection WRC in a foreign language, approved by Order of the rector of 20.06.2016, No. 547.

10. The rules of use of the system "Antiplagiat" to validate written-tion of educational work in people's friendship University, approved by Order of the rector of 30.03.2018, No. 228.

11. Basic literature indicated in the working programme of the subjects/modules of the educational program (during the preparation for the state exam).

*Resources of the Internet information and telecommunications network:*

1. EBS of the RUDN and third-party EBS, to which students of the university have access on the basis of concluded contracts:

- Electronic library system of the RUDN-EBS RUDN

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

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

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

-EBS "Student Consultant" [www.studentlibrary.ru](http://www.studentlibrary.ru)

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

2. Databases and search engines:

- electronic fund of legal and regulatory and technical documentation

<http://docs.cntd.ru/>

search engine Yandex <https://www.yandex.ru/>

- Google search engine <https://www.google.ru/>

- bibliographic database SCOPUS

<http://www.elsevierscience.ru/products/scopus/>

*Software:*

1. Specialized software for conducting the test part of the state exam and independent work of students:

\* MS-office corporate. (RUDN Software) - Registration code: 86626883 Parent program: 86493330

\* Status: Active-11 pcs., the Lira Cad software package - the software package of the Licensed user (key ID 8921065569, 20 workplaces),

\* Lira 9.4, Monomakh-(license agreement to the contract No. 22 / U dated 26. 09. 2007),

\* Academician set 2017-No. 5715 07.06.2017-1 pc. Academician Set 2017-No. 5716 22.03.2017-1 piece.

\* MS-office corporate, Registration Code: 86626883

\* MS Office 2007-corporate RUDN, AKTAKOM ATT-1006, version 1.0.0.1-License: 0745328ot 19.12.2012

\* Plaxis 2D Suit (Network License). Plaxis Professional (version 8) + Plaxis Dinamics Modul + PlaxFlow (version 1) - Education, 25 seats-registration number 90-07-019-00261-3 (2008),

\* Abaqus , 20 seats-registration number 90-07-019-00317-7 (2010),

\* MS-office corporate. (RUDN Software)- Registration code: 86626883 Parent program: 86493330 Status: Active.

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*Methodological materials for independent work of students in the process of preparing a scientific report:*

1. The procedure for the execution and registration of final qualifying works on educational programs of higher education implemented at the RUDN Engineering Academy (approved by the Order of the Director of the Engineering Academy annually or as necessary).

## **8. Material and technical support of the GIA**

To prepare for the state exam and the defense of the WRC, students use the premises for independent work.

To conduct the test part of the state exam, a study audience is required, equipped with workstations with personal computers (at least 12), equipped with the necessary software and connection to the Internet.

To conduct the main part of the state exam and / or the defense of the WRC, a room with a capacity of 12 or more people is necessary, in which workplaces are equipped for all members of the HEC, with the opportunity to listen to reports, view public presentations of speakers, keep records and protocols, there are places for listeners who want to attend the WRC defense procedure. The necessary equipment of the room includes:

- equipment for public presentations of the results of the WRC, including a multimedia screen, a projector, audio equipment.
- a board for illustrating the answers to questions;
- tablets/stands of at least A1 format (if necessary), for placing the graphic part of the WRC on them.

The student can notify the issuing department about the wishes for additional material and technical equipment (if necessary) of the audience assigned for the protection of the WRC by a written application no later than a week before the protection procedure.

## **9. Evaluation Funds Fund**

The fund of evaluation funds formed for the state final certification of students under the educational program Theory of Design of Buildings and Structures / Theory of design of buildings and structures in the direction / specialty 08.04.01 Civil Engineering / Construction includes:

- a list of competencies that students should master as a result of mastering the educational program;
- description of indicators and criteria for assessing competencies, as well as assessment scales;
- standard control tasks or other materials necessary for evaluating the results of mastering the educational program;
- methodological materials that define the procedures for evaluating the results of mastering the educational program.

### **9.1 The list of competencies that students should master as a result of mastering the educational program**

As a result of mastering the educational program " Theory of Design of Buildings and Structures / Theory of design of buildings and structures in the direction 08.04.01 Civil Engineering/ Construction, the graduate must have all the universal, general professional and professional competencies listed in paragraph 3 of this Program.

### **9.2 Indicators, criteria and scales of competence assessment in the process of conducting the GIA**

According to the results of the two stages of the state exam, a total score is given in accordance with the point-rating system adopted at the RUDN (point/ECTS/rating of the Russian Federation).



The assessment received by the student at the first stage is formed on the basis of the test result issued by specialized software (maximum 30 points).

At the second stage of the state exam, the assessment is determined by the results of the verification by the members of the GEC of the student's written answer to the exam ticket and (if necessary) the quality of the student's answers to additional questions from the members of the GEC.

The scale and evaluation criteria of the state exam are presented in Table 2.

*Table 2-Scale and evaluation criteria of the State exam (main part)*

<b>Шкала оценивания</b>	<b>50-60 баллов</b>	<b>30-49 баллов</b>	<b>1-29 баллов</b>	<b>0 баллов</b>
<b>Критерии</b>	<ul style="list-style-type: none"> <li>- полно раскрыто содержание материала экзаменационного билета;</li> <li>- материал изложен грамотно, в определенной логической последовательности;</li> <li>- точно используется терминология;</li> <li>- показано умение иллюстрировать теоретические положения конкретными примерами, применять их в новой ситуации;</li> <li>- ответ прозвучал самостоятельно, без наводящих вопросов;</li> <li>- продемонстрирована способность творчески применять знание теории к решению профессиональных задач;</li> <li>- продемонстрирован высокий уровень сформированности компетенций</li> </ul>	<ul style="list-style-type: none"> <li>- вопросы экзаменационного материала излагаются систематизировано и последовательно;</li> <li>- продемонстрировано умение анализировать материал, однако не все выводы носят аргументированный и доказательный характер;</li> <li>- продемонстрировано усвоение основной литературы.</li> <li>- ответ содержит один из нижеперечисленных недостатков:</li> <li>- в изложении допущены небольшие пробелы, не исказившие содержание ответа;</li> <li>- допущены ошибка или более двух недочетов при освещении второстепенных вопросов, которые легко исправляются по замечанию экзаменатора.</li> </ul>	<ul style="list-style-type: none"> <li>- неполно или непоследовательно раскрыто содержание материала, но показано общее понимание вопроса и продемонстрированы умения, достаточные для дальнейшего усвоения материала;</li> <li>- усвоены основные категории по рассматриваемому и дополнительным вопросам;</li> <li>- имелись затруднения или допущены ошибки в определении понятий, использовании терминологии, исправленные после нескольких наводящих вопросов;</li> <li>- при неполном знании теоретического материала выявлена недостаточная сформированность компетенций, умений и навыков, студент не может применить теорию в новой ситуации;</li> <li>- продемонстрировано усвоение основной литературы.</li> </ul>	<ul style="list-style-type: none"> <li>- не раскрыто основное содержание учебного материала;</li> <li>- обнаружено незнание или непонимание большей или наиболее важной части учебного материала;</li> <li>- допущены ошибки в определении понятий, при использовании терминологии, которые не исправлены после нескольких наводящих вопросов.</li> <li>- не сформированы компетенции, умения и навыки.</li> </ul>

The WRC and its defense are evaluated in accordance with the point-rating system adopted at the RUDN (score / ECTS / rating of the Russian Federation, maximum 100 points) according to the following indicators that allow assessing the level of formation of competencies provided by the educational program:

<b>Показатели оценивания научного доклада</b>	<b>Максимальный балл</b>
- соответствие содержания ВКР утвержденной теме и выданному заданию, четкость формулировки целей и задач исследования	20
- достоверность, оригинальность и новизна полученных в ВКР результатов	10
- практическая ценность выполненной ВКР	10
- стиль изложения ВКР	5
- соблюдение утвержденных требований к оформлению ВКР	10
- качество презентации и доклада при защите ВКР	10
- качество ответов на вопросы при защите ВКР	10
- оценка ВКР руководителем (отзыв)	10
- оценка ВКР рецензентом (рецензия)	10
- наличие публикаций по теме работы, свидетельств, наград и т.п.	5

The WRC and its defense are evaluated in accordance with the point-rating system adopted at the RUDN (score / ECTS / rating of the Russian Federation, maximum 100 points) according to the following indicators that allow assessing the level of formation of competencies provided by the educational program: The scale and criteria for evaluating the WRC defense are presented in Table 3.

Table 3-Scale and criteria for evaluating a scientific report

<b>Соответствие содержания ВКР утвержденной теме, четкость формулировки целей и задач исследования</b>				
<b>Шкала</b>	<b>15-20 баллов</b>	<b>5-14 баллов</b>	<b>1-4 балла</b>	<b>0 баллов</b>
<b>Критерии</b>	ВКР выполнена на актуальную тему, четко сформулированы цели и задачи проводимого исследования.	ВКР выполнена на актуальную тему, имеются незначительные замечания по формулировке целей и задач проводимого исследования.	Актуальность темы ВКР вызывает сомнения. Цели и задачи ВКР сформулированы с существенными замечаниями, не достаточно четко. Нет увязки сущности темы с наиболее значимыми направлениями решения рассматриваемой проблемы.	Цели и задачи ВКР не соответствуют утвержденной теме работы и не раскрывают сущности проводимого исследования.
<b>Достоверность, оригинальность и новизна полученных в ВКР результатов</b>				
<b>Шкала</b>	<b>7-10 баллов</b>	<b>4-6 баллов</b>	<b>1-3 балла</b>	<b>0 баллов</b>
<b>Критерии</b>	Выполнен глубокий анализ объекта исследования. Отмечается достоверность, оригинальность и новизна выводов по теме исследования.	Анализ объекта исследования выполнен недостаточно глубоко. Достоверность, оригинальность и новизна выводов имеют ряд незначительных замечаний.	Достоверность, оригинальность и новизна выводов по полученным результатам вызывает серьезные замечания.	Достоверность результатов ставится под сомнение, оригинальность и новизна результатов отсутствует
<b>Практическая ценность выполненной ВКР</b>				
<b>Шкала</b>	<b>7-10 баллов</b>	<b>4-6 баллов</b>	<b>1-3 балла</b>	<b>0 баллов</b>

Критерии	В работе дано новое решение теоретической или практической задачи, имеющей существенное значение для профессиональной области.	В работе дано частичное решение теоретической или практической задачи, имеющее значение для профессиональной области.	В работе рассмотрены только направления решения задачи, полученные результаты носят общий характер или недостаточно аргументированы.	Результаты не представляют практической ценности
<b>Стиль изложения ВКР</b>				
<b>Шкала</b>	<b>4-5 баллов</b>	<b>2-3 балла</b>	<b>1 балл</b>	<b>0 баллов</b>
Критерии	Отмечается научный стиль изложения результатов работы с корректными ссылками на литературные источники	Имеются незначительные замечания к научности стиля изложения результатов и/или к корректности ссылок на источники	Имеются серьезные замечания к научности стиля изложения результатов работы и/или к корректности ссылок на источники	Стиль изложения не соответствует научному, ссылки на источники некорректны
<b>Соблюдение утвержденных требований к оформлению ВКР</b>				
<b>Шкала</b>	<b>7-10 баллов</b>	<b>4-6 баллов</b>	<b>1-3 балла</b>	<b>0 баллов</b>
Критерии	ВКР полностью соответствует требованиям по оформлению	ВКР с незначительными замечаниями соответствует требованиям по оформлению	ВКР имеет значительные замечания по соответствию требованиям по оформлению	ВКР не соответствует требованиям по оформлению
<b>Качество презентации и доклада при защите ВКР</b>				
<b>Шкала</b>	<b>7-10 баллов</b>	<b>4-6 баллов</b>	<b>1-3 балла</b>	<b>0 баллов</b>
Критерии	Презентация и доклад в полной мере отражают содержание ВКР, продемонстрировано хорошее владение материалом работы, уверенное, последовательное и логичное изложение результатов исследования	Имеются незначительные замечания к презентации и/или докладу по теме ВКР. Были допущены незначительные неточности при изложении результатов ВКР, не искажающие основного содержания работы.	Имеются существенные замечания к качеству презентации и/или доклада по теме ВКР. Были допущены значительные неточности при изложении материала, влияющие на суть понимания основного содержания ВКР, нарушена логичность изложения.	Презентация и/или доклад не отражает сути выпускной работы. Не продемонстрировано владение материалом работы.
<b>Качество ответов на вопросы при защите ВКР</b>				
<b>Шкала</b>	<b>7-10 баллов</b>	<b>4-6 баллов</b>	<b>1-3 балла</b>	<b>0 баллов</b>
Критерии	Ответы на вопросы даны в полном объеме	Ответы даны не полностью и/или с небольшими погрешностями	Ответы на вопросы являются неполными, с серьезными погрешностями	Ответы на вопросы не даны
<b>Оценка ВКР руководителем</b>				
<b>Шкала</b>	<b>7-10 баллов</b>	<b>4-6 баллов</b>	<b>1-3 балла</b>	<b>0 баллов</b>
Критерии	Отлично	Хорошо	Удовлетворительно	Неудовлетворительно
<b>Оценка ВКР рецензентом</b>				
<b>Шкала</b>	<b>7-10 баллов</b>	<b>4-6 баллов</b>	<b>1-3 балла</b>	<b>0 баллов</b>
Критерии	Отлично	Хорошо	Удовлетворительно	Неудовлетворительно
<b>Наличие публикаций по теме работы, свидетельств, наград и т.п.</b>				

Шкала	4-5 баллов	2-3 балла	1 балл	0 баллов
Критерии	Результаты исследования апробированы в выступлениях на конференциях, семинарах, имеются публикации в печати, результаты подтверждены справкой о внедрении и т.д.	Результаты исследования заявлены для доклада на конференциях, семинарах, или приняты к публикации в печати, к внедрению.	Результаты исследования подготавливаются для обсуждения на конференциях, семинарах, или готовятся к публикации в печати, к внедрению.	Результаты исследований не планируются к публикации, докладу на конференциях, семинарах, для внедрения

### 9.3 Standard control tasks or other materials necessary for evaluating the results of mastering the educational program

List of questions to prepare for the test stage of the state exam: Civil Engineering and Built Environment / Строительная инженерия и построенная среда (англ.)

$$w = A_1 r^2 \ln r + A_2 r^2 + A_3 \ln r + A_4 + \frac{1}{D} \int_0^r \frac{1}{r} dr \int_0^r r dr \int_0^r r q dr$$

- 1.
2. Single-storey frame industrial buildings. Purpose of buildings. Design features.
3. Determination of the technical condition of buildings and structures according to survey data.
4. Determination of efforts in the elements of precast concrete trusses. Reinforcement a truss's elements.
5. The main components of the frame (joints of columns, base columns, attaching beams to the columns).
6. The main components of the metal frame (joints of columns, base columns, attaching beams to the columns).
7. The main elements of reinforced concrete structures of one-storey industrial buildings.
8. The first and second quadratic forms of the surface. What surface geometric parameters can be calculated using them.
9. Transverse frame of single-storey industrial buildings made of reinforced concrete. Constant loads acting on the elements of a transverse frame.
10. Transverse frame of single-storey industrial buildings from reinforced concrete. Vertical and horizontal loads from overhead cranes acting on the elements of the transverse frame of the frame.
11. Transverse frame of single-storey industrial buildings from reinforced concrete. Vertical and horizontal loads acting on the elements of the transverse frame.
12. Transverse frame of single-storey industrial buildings from reinforced concrete. Wind loads acting on the elements of the transverse frame.
13. Principles of calculation of the brass joint. What strength conditions are necessary to ensure?
14. The principles of calculation of the connection type of halving. What strength conditions should be provided?
15. Принципы расчета цельнодеревянных изгибаемых элементов. Какие предельные состояния учитываются в расчете?
16. Work and calculation of wood for crumpling. Types of crumpling. Calculation of wooden elements for crumpling.

17. The solution of the differential equation for the deflections of a circular annular plate.
18. Connections on front cutting. Design and calculation.
19. Structures of flat coatings. Types of structures: triangular, square, hexagonal grids. Constructive solutions: types of sections, nodes, connections and bearing on columns. Methods for calculating structures.
20. Theory of shallow shells: displacement method. The solution of the calculated equations rectangular in plan of a shallow shell with articulated support of all 4 sides.
21. 21. Theory of shallow shells: the definition of a shallow shell, the basic assumptions.
22. Equation for round plates. Internal efforts.
23. Physical and mechanical properties of wood and construction plastics.
24. The formula of Hooke's law in the theory of shells. Explain the idea and the meaning, of symbols (letters) included in it.
25. Cylindrical shells: Derivation of the calculated equations in displacements, if the middle surface of the shell is given in curvilinear coordinates  $x, s$  ( $s$  is the length of the arc forming the cylindrical middle surface).

List of questions to prepare for the main part of the state exam Built Environment of Smart City / Городская среда Умного города (англ.).

Reinforcement of the pre-stressed reinforced concrete ribbed slab.

1. A momentless theory of the calculation of shells of revolution (to give a formula for determining the internal forces in a shell loaded with an axisymmetric surface load).
2. A momentless theory of calculating shells of zero Gaussian curvature.
3. Vertical and horizontal connections of one-story reinforced concrete production buildings.
4. Write expressions to determine bending moments, define arbitrary constants for a circular annular plate pivotally supported along the contour, and determine the deflection in the center of the plate.
5. What types of loss of stability of wooden rods were studied in the course, and in what stress-strain states they appear.
6. Constructive solutions of domes: ribbed, ribbed - ring and mesh-type. Advantages and disadvantages of various design solutions, areas of rational use.
7. Designs and features of the calculation of light trusses.
8. Designs of multi-storey frame industrial buildings. Constructive schemes. Assignment of sizes.
9. Constructions of lightweight steel beams coating. Basics of calculations.
10. The design of the precast reinforced ribbed slab coating. Reinforcement of precast reinforced ribbed slab coating.
11. Metal structures of the supporting frame of multi-storey buildings. Loads and impacts. Accounting for load combination factors and lowering the load values of multi-storey buildings.
12. Loads acting on the structure of a multi-storey frame industrial building.
13. What are the types of stress-strain state of wooden structures, reflected in the rules.

14. Name the calculated resistance used in the calculation of wooden structures according to the standards.
15. Scope of large-span structures. Arched and frame structures. Outlines, methods of bearing, static definability of structures. Systems and types of frames. Systems and types of arches.
16. Fire resistance of wood. Constructive and chemical measures to protect wood from fire hazards. Одноэтажные каркасные производственные здания из железобетона. Назначение зданий. Конструктивные особенности.
17. Single-storey frame production buildings of reinforced concrete. Purpose of buildings. Design features.

List of questions to prepare for the main part of the state exam Mechanics of Materials and Engineering Structures / Механика материалов и инженерных конструкций (англ.)

Task 1. Determine the cost of labor and build a schedule for the construction of monolithic reinforced concrete strip foundations with a section of 0.3 \* 0.6 m and a length of 72 m. The accepted number of workers is 3 people.

Task 2. Determine the structure of expenses of the building form for the previous calendar year and perform a comparative assessment of expenses based on the following data: the wage fund - 12,550,000.00 rubles; material costs: metal structures - RUB 16,250,500.00; metal constructions by the customer's dependency - 15 000 300.00 rubles; wall panels "Ventall" - 7,005,430.00 rubles; Coatings panel "Rocwell" - 3,000,000.00 rubles; heavy concrete - 2,250,000.00 rubles; other expenses - 94,070.00 rubles, including: penalties - 1,275,500.00 rubles; expenses for accreditation - 150 000.00 rubles; advertising - 4 200 000,00 rub .; legal fees - 1,600,000.00 rubles; patenting - 74,500.00 rubles; others - 200 000.00 rubles.

*Sample topics of final qualifying works:*

1. Improving the quality of building structures by ensuring the accuracy of their geometrical parameters during the construction of buildings.
2. Improving the technology of erection of residential buildings in fixed formwork.
3. Improving the technology of construction of foundations of rammed ditches.
4. Infrared heating of the concrete mix during the cold season
5. Analysis of the use of palm cake as a concrete aggregate in a tropical climate.
6. Investigation of the effect of basalt fibers on the parameters of the fracture mechanics of self-compacting high-strength concrete
7. Study of the effect of basalt fibers on the physicomaterial properties of self-compacting high-strength concrete.
8. Research of methods for assessing the reliability of outdoor water supply networks in populated areas.
9. Investigation of methods for assessing the reliability of outdoor water disposal networks of populated areas.
10. Analysis of methods for assessing the reliability of building technological systems.
11. Innovative technology of winter concreting of building structures.
12. The project of production work on the construction of the cottage with the development of a technological map on the roofing.
13. Innovative technology of foundation foundations in ragged pits.

14. The project of production of works on the construction of a single-span industrial building with a technological map for the installation of steel structures.
15. Analysis of the economic efficiency of the construction company on the basis of the break-even point.
16. Development of a flow chart for the device of the potato storage ventilation system.
17. Examination of exhaust plume of smoke exhaust ventilation system.
18. Analysis of methods for calculating smoke ventilation systems.
19. Investigation of the supply air torch with mechanical stimulation.
20. The use of the Lorenz curve in the management system of a building enterprise.
21. The study of the reliability of water fittings in water supply systems for residential buildings.
22. Improving the quality of building structures by ensuring the accuracy of their geometrical parameters during the construction of buildings.
23. Improving the technology of erection of residential buildings in fixed formwork.
24. Improving the technology of building foundations of rammed pits.
25. Infrared heating of the concrete mix during the cold season.
26. Analysis of the use of palm cake as a concrete aggregate in tropical climates.
27. Study of the effect of basalt fibers on the parameters of fracture mechanics.
28. Study of the effect of basalt fibers on the physicomaterial properties of self-compacting concrete.
29. Study of the technology of external walls using ventilated facades with the development of a technological map.
30. Study of the effect of basalt fibers on the parameters of the mechanics of concrete destruction.

#### 9.4 Methodological materials defining the procedures for evaluating the results of mastering the educational program

##### Methodology for evaluating the results of the state exam

According to the results of the two stages of the state exam, a total score is given in accordance with the point-rating system adopted at the RUDN (point/ECTS/rating of the Russian Federation).

At the first stage (the test part), the student can get a maximum of 40 points. The assessment received by the student at the first stage is formed on the basis of the test results issued by specialized software, and is included in the state exam statement and the minutes of the meeting of the State Technical Committee.

At the second stage, the student can get a maximum of 60 points. The assessment is determined based on the results of verification by the members of the GEC of the student's written response to the examination ticket and (if necessary) the quality of the student's answers to additional questions from the members of the GEC. The assessment received by the graduate based on the results of the second stage of the state exam is also displayed in the state exam statement.

The total assessment received by the student according to the results of the state exam is put down in the examination sheet (by the chairman of the SES), in the minutes of the meeting of the SES (by the secretary of the commission) and is brought to the graduate.

If at one of the stages of the state exam a student receives " 0 " points or does not appear for the certification test without a valid reason, then the result of passing the state exam by such a student is "unsatisfactory".

### Methodology for evaluating the results of the protection of the WRC

For the efficiency and convenience of the work of the members of the GEC, it is recommended to provide them with an auxiliary document "A worksheet for assessing the formation of competencies during the GIA", the form of which is given in Annex 1.

In the process of hearing the scientific report, the members of the GEK set points for each of the above indicators. At the end of the presentation of the report, each of the members of the GEC summarizes all the points put down.

The final assessment of the formation of competencies is an assessment made based on the results of hearing a scientific report by all members of the GEK who were present at the hearing. To determine the final score, it is necessary to calculate and round off the arithmetic mean of the scores issued by all members of the state commission. In the event of disputed issues, the chairman of the HEC has the right of a decisive vote.

The total assessment received by the student based on the results of the presentation of the scientific report is put down in the examination sheet (by the chairman of the SES) and in the protocol of the meeting of the SES (by the secretary of the commission). Приложение 1

<b>РАБОЧИЙ ЛИСТ</b>		
<b>оценки сформированности компетенций при проведении ГИА</b>		
<b>Направление подготовки:</b>		
<b>Образовательная программа (научная специальность):</b>		
<b>ФИО члена ГЭК:</b>		
<b>Дата:</b>		
<b>Аттестационное испытание:</b>	<i>Защита ВКР</i>	
<b>ФИО выпускника:</b>		
<b>Показатели оценивания защиты ВКР</b>	<b>Максимальный балл</b>	<b>Фактический балл</b>
- соответствие содержания научного доклада утвержденной теме НКР и выданному заданию, четкость формулировки целей и задач исследования	20	
- достоверность, оригинальность и новизна полученных в НКР результатов	10	
- практическая ценность выполненной НКР	10	
- стиль изложения научного доклада	5	
- соблюдение утвержденных требований к оформлению НКР	10	
- качество презентации и доклада	10	
- качество ответов на вопросы членов ГЭК	10	



- оценка научной работы аспиранта руководителем (отзыв)	10	
- оценка НКР рецензентом (рецензия)	10	
- наличие публикаций по теме работы, свидетельств, наград и т.п.	5	
Сумма баллов:	100	
Подпись члена ГЭК		

### **Fund of assessment funds for conducting intermediate certification of students in the discipline (module)**

Materials for assessing the level of development of educational material of the discipline "Structural Finite Element Method for Civil Infrastructure", including a list of competencies, indicating the stages of their formation, description of the indicators and criteria of assessment of competencies at different stages of their formation, the description of the scales of assessment, typical assignments, or other materials needed for the assessment of knowledge, skills and (or) experience activities that characterize the stages of formation of competences in the process of development of educational programs, instructional materials, procedures evaluation of knowledge, skills and (or) experience activities that characterize the stages of formation of competences, fully developed and available to students on the page of discipline in TUIS RUDN.

#### **Developer:**

Assistant at the Department of Civil engineering



T.H. Gebre

#### **Program Manager**

Ass. Professor at the Department of Civil engineering



M. I. Rynkovskaya

Director of the Department of civil engineering



M. I. Rynkovskaya