Course title	AUTOMATION OF STRUCTURAL ANALYSIS OF BUILDING STRUCTURES (10 ECTS)
Topic/module code	QKXA1210
Semesters in which the course is taught	Semester 2/3
Assigned instructor	Djuraye Uktam Uralboyevich, Associate Professor
Language of instruction	Uzbek
Course type	Compulsory
Study hours (including independent study)	**Total hours - 300.** **Classroom hours - 100.** Lecture hours - 16 Laboratory hours - - Practical class hours - 84 **Independent study - 200 hours**
ECTS	10
Course aims and objectives / learning outcomes	**The aim of the course** is to introduce master's students to computer software for the analysis and design of buildings and structures, and to teach them to select cross-sections for structural elements and to make effective use of modern methods in their design. To achieve this aim, the course develops students' theoretical knowledge, practical skills, a methodological approach to construction processes, and a scientific worldview. **The objective of the course** - master's students should study modern analysis methods, know how to build a computer model of the design process and have the skills to solve it; they should also be able to solve their own problems using standard software, solve engineering and economic problems with modern application software, and master methods of using computer technologies effectively in solving professional problems.
Course content (topics)	**I. Main theoretical part (Lectures)** Topic 1: Aims and objectives of automating the analysis of building structures.. Topic 2: Definition and overview of software used in design and construction.. Topic 3: Toolbar. Ribbon interface elements. Application menu. The “Создание и редактирование” (Creation and Editing) ribbon tab, the “Расширенное редактирование” (Advanced Editing) ribbon tab, the “Расчет” (Analysis) ribbon tab.. Topic 4: Modelling a plane frame of a two-span, two-storey building. Topic 5: Analysis and design of reinforced concrete structural cross-sections in the LIR-ARM system. Generating the table of analysis results. Topic 6: Slab analysis. Topic 7: Creating the geometric scheme of an industrial building frame. Topic 8:. Creating the geometric scheme of the spatial frame of a building with a slab foundation on an elastic subgrade **II. Guidelines and recommendations for organizing laboratory classes.** Laboratory classes are not provided for in the curriculum. **III. Guidelines and recommendations for practical classes** The instructor's preparation for a practical class begins with studying the initial documents (curriculum, thematic plan, etc.) and ends with drawing up a lesson plan. The instructor must have a clear idea of the aims and objectives of the practical class and of the amount of work each student is to complete. Methodological guidelines are the instructor's main methodological

document for preparing and conducting practical classes.

The aim of a practical class is to understand the theory and acquire skills. It consists in developing the ability to apply it consciously in academic and professional activity and to formulate one's own point of view convincingly.

Recommended practical topics :

1. Analysis and design of a column.
2. Analysis of a single-span, single-storey frame.
3. Modelling a plane frame of a two-span, two-storey building.
4. Analysis of a flat slab.
5. Creating the geometric scheme of an industrial building frame
6. Assigning stiffness properties to the elements of an industrial building frame.
7. Applying loads to an industrial building frame.
8. Creating the geometric scheme of the spatial frame of a building with a slab foundation on an elastic subgrade
9. Creating the geometric scheme of the spatial frame of a building with a slab foundation on an elastic subgrade.
10. Creating the geometric scheme of a steel tower. Assigning stiffness properties to the steel tower elements. Performing the static analysis of the steel tower and calculating the load effect on the foundation.
11. Creating the geometric scheme of a cylindrical tank. Performing the static analysis of the cylindrical tank and analysing the results.
12. Setting up the problem of analysing a multi-storey beamless frame building and designing a monolithic reinforced concrete slab using the SAPFIR-KONSTRUKSIYA and SAPFIR-JBK systems .
13. Creating and editing floor slabs
14. Modelling a ramp
15. Creating load cases and applying loads.
16. Opening the design model in the PK LIRA-SAPR system
17. Designing a monolithic reinforced concrete floor slab using the SAPFIR- JBK system
18. Additional reinforcement of a reinforced concrete slab using the SAPFIR-JBK system
19. Creating the geometric model for detailing monolithic columns and beams using the SAPFIR – JBK system 20. Additional reinforcement of a reinforced concrete slab using the SAPFIR-JBK system
20. Creating the marking section of vertical elements
21. Creating a drawing sheet with marking plans and sections
22. Detailing a monolithic reinforced concrete column
23. Correcting the automatic detailing of beams. Creating a drawing sheet for a beam
24. Setting up the design problem for a reinforced concrete shear wall (diaphragm) in the SAPFIR-JBK program
25. Automatically changing the layout of shear wall drawings. Creating an opening in a unified shear wall group
26. Adjusting the reinforcement zone spacing to the module
27. Fitting reinforcement to a window frame
28. Working with the shear wall section
29. Arranging support zones. Dimensioning reinforced joints. Creating shear wall drawings in automatic mode
30. Creating the geometry of a structure on a soil base using the new GRUNT (soil) system
31. Assigning boundary conditions to the frame
32. Assigning stiffness properties to the frame elements
33. Specifying elastic subgrade parameters
34. Applying loads. Performing the static analysis of the frame

35. Viewing and analysing the results
36. Making corrections to the automatic detailing
37. Creating a drawing sheet for a beam
38. Designing a reinforced concrete shear wall using the SAPFIR-JBK system
39. Calculating the reinforcement for a shear wall and collecting the minimum data required for design
40. Importing the reinforcement results. Automatic design of a shear wall. Automatic construction of shear walls with openings. Working with the shear wall section
41. Creating reinforcement joints. Visualizing reinforcement in 3D
42. Automatic generation of drawings in the system

IV. Independent study and independent work.

The independent study competence serves to support students' independent self-development and to increase the effectiveness of their professional activity. Students complete independent work on their mobile devices under the instructor's guidance, in traditional or electronic form.

Recommended topics for independent study:

1. Aims and objectives of the analysis and design of building structures.
2. Definition and overview of software used in design and construction
3. The ribbon interface of PK LIRA-SAPR® 2017.
4. Modelling a plane frame of a two-span, two-storey building.
5. Assigning constraints and hinges.
6. Applying loads.
7. Analysis and design of reinforced concrete structural cross-sections in the LIR-ARM system.
8. Generating the table of analysis results.
9. Slab analysis.
10. Creating the geometric scheme of an industrial building frame.
11. Assigning stiffness properties to the elements of an industrial building frame
12. Applying loads to an industrial building frame
13. Performing the static analysis of the frame. Stability analysis of the frame.
14. Creating the geometric scheme of the spatial frame of a building with a slab foundation on an elastic subgrade
15. Assigning stiffness to the spatial frame elements
16. Performing the static analysis of the spatial frame and analysing the results
17.Setting up the analysis problem for a steel tower
18. Creating the geometric scheme of a steel tower
19. Assigning stiffness properties to the steel tower elements
20. Performing the static analysis of the steel tower and calculating the load effect on the foundation
21. Setting up the problem of analysing a multi-storey beamless frame building and designing a monolithic reinforced concrete slab using the SAPFIR-KONSTRUKSIYa and SAPFIR-JBK systems
22. Creating and editing floor slabs
23. Modelling a ramp
24. Creating load cases and applying loads
25. Opening the design model in the PK LIRA-SAPR system
26. Designing a monolithic reinforced concrete floor slab using the SAPFIR- JBK system
27. Additional reinforcement of a reinforced concrete slab using the SAPFIR-JBK system.
28 Creating the geometric model for detailing monolithic columns and

	beams using the SAPFIR – JBK system 29. Creating the marking section of vertical elements; 30. Creating a drawing sheet with marking plans and sections. 31. Detailing a monolithic reinforced concrete column 32. Correcting the automatic detailing of beams 33. Creating a drawing sheet for a beam. 34. Setting up the design problem for a reinforced concrete shear wall (diaphragm) in the SAPFIR-JBK program 35. Automatically changing the layout of shear wall drawings. 36. Creating an opening in a unified shear wall group 37. Adjusting the reinforcement zone spacing to the module. 38. Fitting reinforcement to a window frame. 39. Working with the shear wall section 40. Arranging support zones
Student assessment	Assessment of students' knowledge is based on indicators of mastery of the course material during the semester and the final assessment (results of tests, assignments, written and oral work). During the course "Assessment of the Technical Condition of Buildings and Structures", students are assessed on a 100-point scale. Of these, 50 points are allocated to current and midterm results (60% of the 50 points for current assessment and independent study, and 40% for midterm assessment), and 50 points to the final assessment result. Students whose combined current and midterm score is below 30 points are not admitted to the final examination. A student who scores 30 or more points in the final assessment is considered to have passed the course.
Examination requirements	The student must have fully mastered the theoretical and practical concepts of the topic and be able to present the results of analysis correctly. The student must have completed the assignments given for independent work and for the current and midterm forms of assessment. In addition, within the set time, the student must have obtained the required points in the current, midterm, independent study and final assessments for the course. A student who has not submitted the current assessment, midterm assessment and independent study assignments, or who has scored less than 30 points for these assignments and forms of assessment, is not admitted to the final assessment. In addition, a student who has missed 25% or more of the classroom hours allocated to the course without a valid reason is excluded from the course, is not admitted to the final examination, and is considered not to have earned the corresponding credits for the course. A student who fails the final examination or scores in the range of "0–29.9" points in such examinations is considered to have an academic debt.
Recommended literature	*1. U.U. Djurayev. Computer Technologies in the Design of Building Structures. Textbook. Jizzakh, 2023, 246 pp.* *2. Matkarimov S.Yu. Computer Technologies in the Design of Building Structures. Textbook. Tashkent, 2020.* *3. Matkarimov S.Yu., Nizomov Sh.R. Analysis and Automation of Building Structures Based on Computer Programs. Tashkent, 2013* *4. Yusupxodjayev S.A. "Building Structures". Textbook. Tashkent. "National Society of Philosophers of Uzbekistan", 2019, 376 pp.* *5. E.V. Lebed. «Computer Technologies in the Design of Spatial Steel Frames of Buildings». Moscow, MGSU, 2017, 141 pp.* 6. Mirziyoyev Sh.M. The Rule of Law and Ensuring Human Interests Are the Guarantee of the Country's Development and the People's Well-being. Tashkent: "Uzbekiston", 2016, 47 pp. 7. ShNQ (QMQ) 2.01.03-19. Construction in Seismic Areas. Ministry of Construction of the Republic of Uzbekistan, Tashkent, 2019.. *8.* www.mc.uz

	9. https://gov.uz/oz/mc/sections/shaharsozlik-normalari-qurilish-va-texnik-reglamentlar *10.* www.ZiyoNet.uz 11. www.twirpx.com