Course title	Seismic Resistance of Buildings and Structures (ECTS 6)
Course/module code	BIZ2706
Semester(s) in which the course is taught	7th semester
Instructor	Mashrab Rahmonqulovich Aliyev, Associate Professor
Language of instruction	Uzbek
Course type	Elective
Study workload (including independent study)	**Total workload – 180 hours.** **Contact hours – 72 hours.** Lectures – 36 hours. Laboratory classes – not provided for in the curriculum. Practical classes – 36 hours. **Independent study – 108 hours.**
ECTS	6
Course aims, objectives and learning outcomes	**Course aim –** to develop students' theoretical knowledge, practical skills and professional competencies in seismic analysis of buildings and structures, their design in seismic zones, and the provision of seismic resistance. **Course objectives –** to teach students: - the causes, types and main characteristics of earthquakes; - methods for assessing seismic waves, earthquake intensity and energy; - the principles of seismic zoning and microzonation; - methods for determining the dynamic characteristics of buildings and structures; - procedures for calculating seismic loads in accordance with current building codes and regulations; - the principles of earthquake-resistant design of frame, masonry and large-panel buildings; - seismic protection devices and methods for improving seismic resistance. **Learning outcomes:** 1. Understands the theoretical foundations of earthquake-resistant construction, types of earthquakes and parameters of seismic action. 2. Can use seismic zoning and microzonation data. 3. Can apply regulatory requirements for the design of buildings and structures in seismic areas. 4. Can select static and dynamic analysis models for buildings and structures. 5. Can determine the stiffness, natural vibration frequencies and periods of structural systems. 6. Can calculate design seismic loads in accordance with applicable regulatory documents. 7. Can analyse earthquake-resistant structural solutions for frame, masonry and large-panel buildings. 8. Can select seismic protection systems and measures to improve seismic resistance.
Course content (topics)	**I. Main theoretical part (Lectures)** **Topic 1:** Introduction. The aims, objectives and significance of the course "Seismic Resistance of Buildings and Structures" and its relationship with other disciplines. **Topic 2:** Earthquakes and their effects on buildings and structures. Causes of earthquakes and their main characteristics. **Topic 3:** Consequences of major earthquakes. Experience gained from major earthquakes in Uzbekistan and other countries. **Topic 4:** Seismic waves, earthquake intensity and energy. Seismic scales and methods for assessing earthquake intensity. **Topic 5:** Seismic zoning and microzonation. Influence of the

	engineering-geological and soil conditions of a construction site. **Topic 6:** Fundamentals of the theory of seismic resistance. Selection of dynamic analysis models for buildings and structures. **Topic 7:** Basic principles of seismic analysis of buildings and structures. Dynamic forces and deformations. **Topic 8:** Theoretical and practical methods for determining seismic forces: the Omori, Mononobe and K. S. Zavriev methods. **Topic 9:** M. Biot's spectral method and I. L. Korchinsky's method. Scope of application and limitations of the calculation methods. **Topic 10:** Seismic analysis of buildings and structures in accordance with current building codes and regulations. Requirements of ShNQ 2.01.03-26. **Topic 11:** Importance, seismicity, recurrence and other design coefficients considered in seismic analysis. **Topic 12:** Seismic resistance of architectural monuments and historic buildings. Traditional structural solutions and their preservation. **Topic 13:** Seismic requirements for the urban-planning, spatial-planning and structural solutions of buildings. **Topic 14:** Principles of designing earthquake-resistant frame buildings. Requirements for frame members and joints. **Topic 15:** Design of earthquake-resistant masonry buildings. Walls, tie beams and vertical elements. **Topic 16:** Design of earthquake-resistant large-panel buildings. Panel connections and provision of spatial stiffness. **Topic 17:** Seismic protection devices for buildings and structures. Seismic isolation and energy-dissipation systems. **Topic 18:** Improving the seismic resistance of existing buildings and structures. Strengthening, reconstruction and modern technologies. **II. Guidelines and recommendations for laboratory classes** Laboratory classes are not included in the curriculum **III. Guidelines and recommendations for practical classes** The purpose of practical classes is to reinforce the theoretical knowledge acquired during lectures, master seismic analysis methods and develop the skills required to apply them when solving practical engineering problems. Recommended practical topics: 1. Selection of static and dynamic analysis models for buildings and structures. 2. Determination of the geometric characteristics of load-bearing structural members. 3. Calculation of the relative and combined stiffness of structural members. 4. Determination of unit displacements in buildings and structures. 5. Determination of the dynamic characteristics of buildings and structures. 6. Determination of the design loads accumulated at roof and floor levels. 7. Calculation of the natural vibration frequencies and periods of buildings and structures. 8. Determination of the natural vibration modes and modal coefficients of a building. 9. Determination of spectral coefficients in accordance with regulatory documents. 10. Selection of initial data taking into account seismic zone and soil conditions. 11. Determination of importance, earthquake recurrence, number-of-storeys and regularity coefficients. 12. Determination of seismicity and energy-dissipation coefficients.

	13. Determination of design seismic forces for the first mode of vibration. 14. Determination of design seismic forces for the second mode of vibration. 15. Calculation of bending moments in building members caused by seismic forces. 16. Construction of bending-moment diagrams for the first and second modes of vibration. 17. Determination of resultant bending moments and design internal forces. IV. Independent study and individual assignments Independent study is intended to reinforce the knowledge acquired during lectures and practical classes, enable students to independently master seismic analysis methods, work with regulatory documents and develop professional competencies. Independent assignments may take the form of reports, calculation-and-graphics tasks, presentations, analyses of regulatory documents and design solutions. Recommended topics: **1. Analysis of seismic activity in Uzbekistan and the consequences of historical earthquakes.** 2. Study of the relationship between earthquake intensity, magnitude, intensity level and energy. 3. Study of procedures for using seismic zoning and microzonation maps. 4. Analysis of the physical and mechanical properties of soils and their influence on the seismic resistance of buildings. 5. Independent assignment on the selection of dynamic analysis models for buildings and structures. 6. Calculation of the relative stiffness of frame-building members. 7. Determination of unit displacements of a frame building in the horizontal direction. 8. Determination of the natural vibration frequency and period of a frame building. 9. Calculation of vibration modes and modal coefficients of a frame building. 10. Selection of coefficients used in determining seismic loads in accordance with regulatory documents. 11. Determination of design seismic loads acting on a frame building. 12. Determination of bending moments and construction of the corresponding diagram for the first mode of building vibration. 13. Determination of bending moments and construction of the corresponding diagram for the second mode of building vibration. 14. Determination of resultant bending moments for the first and second modes of vibration. 15. Analysis of earthquake-resistant structural solutions for frame buildings. 16. Study of seismic requirements and structural measures for masonry and large-panel buildings. 17. Study of the operating principles of seismic isolation and energy-dissipation devices. 18. Development of a technical solution to improve the seismic resistance of an existing building.
Student assessment	Student assessment is based on the level of mastery of the course materials during the semester and final assessment, as demonstrated through tests, assignments, written work and oral responses. Students are assessed in accordance with the applicable 100-point grading system and the relevant institutional regulations. Assessment takes into account continuous and midterm assessment results,

	completion of independent-study assignments and the final examination result.
Examination requirements	Students must fully master the theoretical and practical concepts covered in the course and complete assignments involving the determination of seismic loads and calculation of the dynamic parameters of buildings and structures. Students are also required to submit independent work and complete the tasks set for continuous and midterm assessment. Admission to the final examination for students who have not completed continuous assessment, midterm assessment or independent-study assignments is determined in accordance with the applicable procedures. Attendance at contact classes and fulfilment of final examination requirements are governed by the current internal regulations of the higher education institution.
Recommended literature	1. Raxmonov B., Sagdiyev X., Yunusaliyev E. Inshootlar dinamikasi va zilzilabardoshligi asoslari. Darslik. – Toshkent: Cho‘lpon, 2013. – 288 b. 2. Aliyev M.R. Bino va inshootlar zilzilabardoshligi. O‘quv qo‘llanma. – Jizzax: “So‘g‘diyona nashriyot matbaa uyi”, 2023. – 108 b. 3. Raxmonov B., Siddiqov M. Binolar zilzilabardoshligi. O‘quv qo‘llanma. – Toshkent: Fan va texnologiya, 2007. – 232 b. 4. Seysmologiyaga kirish: uchinchi nashr. 1-jild. – Toshkent: Donishmand ziyosi, 2025. – 264-b. 5. Seysmologiyaga kirish: uchinchi nashr. 2-jild. – Toshkent: Donishmand ziyosi, 2025. – 232-b. 6. QMQ 2.01.03-96. Zilzilaviy hududlarda qurilish. – Toshkent, 1996. 7. QMQ 2.01.03-19. Seysmik hududlarda qurilish. – Toshkent, 2019. 8. ShNQ 2.01.03-26. Seysmik hududlarda qurilish. – Toshkent, 2026. 9. https://mc.uz 10. https://gov.uz/oz/mc/sections/shaharsozlik-normalari-qurilish-va-texnik-reglamentlar