Course title	**Reinforced Concrete and Masonry Structures (ECTS 10)**
Topic/Module code	TBK1510
Semester(s) in which the course is taught	3–4 / 5–7 semesters
Assigned instructor	Ablayeva O‘g‘iloy Shodiqulovna, Associate Professor
Language of instruction	Uzbek
Course type	Compulsory
Study workload (including independent study)	**Total workload – 300 hours.** **Contact hours – 120 hours.** **Lectures – 48 hours.** **Laboratory classes – 24 hours.** **Practical classes – 48 hours.** **Independent study – 180 hours.**
ECTS credits	10
Course aim, objectives and learning outcomes	The aim of the course is to provide future civil engineers with sound theoretical knowledge and practical skills in the analysis, design and construction of reinforced concrete and masonry structures, as well as in their efficient and safe operation. The objectives of the course are to teach students the theoretical principles and practical skills required for the proper analysis, design and construction of reinforced concrete and masonry structures and for their safe and efficient use. **Learning outcomes:** 1. Understand the principles of analysing reinforced concrete and masonry structural elements in accordance with current regulatory documents and selecting appropriate structural solutions. 2. Understand loads and actions, reliability factors, and the characteristic and design strengths of concrete and reinforcement. 3. Analyse reinforced concrete flexural members for strength in terms of their cross-sections and inclined sections. 4. Understand the principles for analysing tensile and compressive members according to the first and second groups of limit states. 5. Understand the structural systems of buildings and structures, including roof and floor structures. 6. Understand methods for ensuring the strength, stiffness, crack resistance and durability of reinforced concrete and masonry structures.
Course content (topics)	**I. MAIN THEORETICAL PART (LECTURES)** Topic 1. General information on reinforced concrete structures and the design procedure. Aims and objectives of analysing and designing reinforced concrete structures. Requirements for reinforced concrete structures. The concept of reinforced concrete. History of the development of reinforced concrete structures. Advantages and disadvantages of reinforced concrete. Fields of application of reinforced concrete structures. Topic 2. Definition of the limit-state concept; design values of actions; material properties and geometrical characteristics of structures; design rules for ultimate and serviceability limit states. Topic 3. Determination of characteristic values of permanent loads and wind and snow actions. Effects of concrete creep and shrinkage on the structure of reinforced concrete. Topic 4. Physical and mechanical properties of concrete. Concrete composition and strength. Cube strength and prism strength of concrete. Deformation of concrete. Concrete strength classes and grades. Topic 5. Physical and mechanical properties of reinforcing steel. Types of reinforcement according to function, surface shape and application. Characteristics of reinforcement. Methods of reinforcing structural members. Topic 6. Characteristics of creep and shrinkage in concrete members. Moduli of elasticity of concrete and reinforcement. Topic 7. Characteristics of concrete and steel that influence changes in the structure of reinforced concrete under normal operating and extreme conditions. Design and verification of the ultimate and serviceability states of reinforced concrete structures. Topic 8. Prestressed reinforced concrete structures. Advantages and principles

	of prestressing. Methods of tensioning. Design of prestressed reinforced concrete structures. Mechanical, thermal and thermomechanical methods of prestressing reinforcement. Losses of stress in prestressing steel. Determination of stresses in prestressed reinforced concrete members. Topic 9. Strength analysis of reinforced concrete flexural members based on normal cross-sections. Rectangular members with single reinforcement. Design of rectangular sections using tables. Analysis of T-shaped sections. Flexural reinforced concrete members with double reinforcement. Topic 10. Strength analysis of reinforced concrete flexural members based on inclined sections. Effects of shear forces and bending moments on inclined sections. Topic 11. Specific design features of reinforced concrete compression members. General information on compression members. Design and reinforcement of compression members. Transverse reinforcement. Consideration of member deflection. Design of members with accidental eccentricity. Topic 12. Strength analysis of reinforced concrete compression members. Analysis of members with accidental eccentricity. Analysis of eccentrically compressed reinforced concrete members. Determination of the reinforcement area in compression members. Design schemes for compression members. Topic 13. Design and analysis of reinforced concrete tension members. General information on tension members. Strength analysis of members subjected to concentric and eccentric tension. Topic 14. Crack-resistance analysis of reinforced concrete members. Crack resistance of reinforced concrete structures. Analysis of normal cracks in flexural members and inclined cracks in structural members. Crack width in reinforced concrete members. General principles and calculation of the width of normal and inclined cracks. Topic 15. Deformation of reinforced concrete flexural members. Calculation of deformation. Curvature of reinforced concrete members in uncracked regions. Deformation of flexural members in cracked regions. Curvature in cracked regions. Determination of deflection of reinforced concrete members. Topic 16. Flat reinforced concrete floor slabs. General information. Precast beam-and-slab floors. Layout of precast floor systems. Structural schemes of precast beam-and-slab floors. Analysis and design of precast reinforced concrete panels. Topic 17. Monolithic ribbed floor slabs. Structural schemes of floor systems. Design and analysis of slabs, main beams and secondary beams. Structural detailing of slabs, secondary beams and main beams. Monolithic ribbed slabs supported along their edges. Structural schemes and specific analysis features of ribbed monolithic slabs supported along their perimeter. Determination of internal forces in slabs supported along their edges. Design schemes for such floor systems and calculation models for perimeter-supported slabs. Topic 18. Subsoil and foundations. Fundamentals of foundation and subsoil design and analysis. Analysis of subsoil bearing capacity. Types of foundations. Topic 19. Shallow foundations on natural ground. Design principles for shallow foundations. Determination of the base dimensions of rigid foundations under concentric loading. Eccentrically loaded foundations and fundamentals of analysing foundations subjected to bending. Specific design features of foundations on settlement-prone soils and in seismic areas. Topic 20. Fundamentals of foundation design, analysis and reinforcement. General information on foundations. Column footings. Analysis of isolated foundations. Design model of an isolated footing. Column foundations and pile-supported column foundations. Reinforcement of column pedestals and foundations. Topic 21. Raft and continuous foundations. Raft foundations. Strip and raft foundations. Strip foundations beneath walls. Eccentrically loaded foundations and their design models. Topic 22. Design and analysis of masonry and reinforced masonry structures. History of the development of masonry structures. Physical and mechanical properties of materials used in masonry. Analysis of masonry structures. Specific structural properties of reinforced masonry. Fundamentals of reinforced masonry analysis. Analysis of members reinforced with mesh reinforcement. Topic 23. Design of structures for single-storey framed buildings. General information on buildings and structures. Single-storey industrial buildings.

Portal-frame systems. Frame-and-bracing systems.
Topic 24. Design and analysis of multi-storey building structures. Analysis of multi-storey buildings under principal and special loads. Analysis of frames under vertical loads.

II. GUIDELINES AND RECOMMENDATIONS FOR LABORATORY CLASSES

1. Determination of the physical and mechanical properties of concrete.
2. Determination of the physical and mechanical properties of reinforcing steel.
3. Analysis of flexural members based on normal cross-sections.
4. Analysis of flexural members based on inclined cross-sections.

III. GUIDELINES AND RECOMMENDATIONS FOR PRACTICAL CLASSES

Preparation for practical classes begins with the instructor's study of the relevant initial documents (the curriculum, thematic plan and other materials) and concludes with the preparation of the lesson plan. The instructor should have a clear understanding of the aims and objectives of each practical class and the scope of work to be completed by each student.
Methodological guidelines are the principal instructional document used by the instructor when preparing and conducting practical classes.
The purpose of practical classes is to develop an understanding of theoretical material and acquire practical skills, apply them consciously in educational and professional activities, and develop the ability to formulate and substantiate one's own position.

Recommended practical topics:

1. Materials used in reinforced concrete structures.
2. Determination of the anchorage zone of reinforcement in concrete.
3. Effect of concrete shrinkage on reinforced concrete.
4. Effect of concrete creep on reinforced concrete.
5. Procedure for analysing reinforced concrete structures.
6. The limit-state method.
7. Analysis of compression members.
8. Design of compression members.
9. Analysis and design of tension members.
10. Analysis of prestressed members.
11. Calculation of the design value of permanent loads on a reinforced concrete slab.
12. Calculation of the design value of permanent loads on a reinforced concrete beam.
13. Analysis of flexural members.
14. Calculation of the longitudinal reinforcement area for a reinforced concrete beam with a rectangular cross-section.
15. Calculation of the longitudinal reinforcement for a flexural reinforced concrete beam with a T-shaped cross-section.
16. Determination of the dimensions and longitudinal reinforcement of a T-section beam in a monolithic ribbed floor.
17. Calculation of the amount of longitudinal reinforcement for a reinforced concrete column.
18. Calculation of the longitudinal reinforcement for an eccentrically compressed column in a single-storey building without a crane.
19. Strength analysis of a reinforced concrete column in a single-storey industrial building.
20. Determination of stress losses in prestressed reinforcement.
21. Crack-resistance analysis of a beam based on its normal cross-section.
22. Crack-resistance analysis of a beam based on its inclined cross-section.
23. Analysis of stresses in reinforced concrete columns.
24. Design of transverse reinforcement for a reinforced concrete beam: calculation of bar diameter and spacing.

IV. INDEPENDENT STUDY AND INDIVIDUAL WORK

Independent study is intended to support students' self-development and improve their professional performance. Students complete independent assignments using their mobile devices, under the instructor's guidance, in traditional or electronic format.

Recommended topics for independent study:

1. Determination and selection of the cross-sectional area of the longitudinal

	tensile reinforcement of a reinforced concrete beam when the beam dimensions, concrete and reinforcement grades, design bending moment, concrete working-condition factor and concrete cover are known. 2. Determination and selection of the dimensions and cross-sectional area of the longitudinal tensile reinforcement of a reinforced concrete beam when the concrete and reinforcement grades, design bending moment, concrete working-condition factor and concrete cover are known. 3. Classification of reinforced concrete; precast, cast-in-situ and precast-monolithic reinforced concrete structures. 4. Precast reinforced concrete structures and their manufacturing methods: the long-line bed method and the cassette method. 5. Determination and selection of the cross-sectional area of the longitudinal tensile reinforcement of a reinforced concrete beam based on its dimensions, concrete and reinforcement grades, design bending moment, concrete working-condition factor and concrete cover. 6. Structural features of frame elements in single-storey industrial buildings constructed in seismic regions. 7. Contributions of Uzbek scholars to the development of reinforced concrete theory and practice; the general history of reinforced concrete structures and the scientific work of scholars in Uzbekistan. 8. Determination and selection of the dimensions and longitudinal tensile reinforcement area of a reinforced concrete beam based on its concrete and reinforcement grades, design bending moment, concrete working-condition factor and concrete cover. 9. General characteristics of bridge structures in Tashkent; principal elements and design schemes of reinforced concrete bridges in Tashkent; effective solutions for bridge structures. 10. Determination and selection of the cross-sectional area of the longitudinal tensile reinforcement of a reinforced concrete beam based on its dimensions, concrete and reinforcement grades, design bending moment, concrete working-condition factor and concrete cover. 11. Ensuring the local stability of residential building structures in Yashnobod District; seasonal technical inspections of residential building structures; requirements for ensuring local stability. 12. Determination and selection of the dimensions and longitudinal tensile reinforcement area of a reinforced concrete beam based on its concrete and reinforcement grades, design bending moment, concrete working-condition factor and concrete cover. 13. Analytical comparison of steel and composite reinforcement; study of the properties of steel and composite reinforcement; comparison of their economic and structural efficiency. 14. Determination and selection of the cross-sectional area of the longitudinal tensile reinforcement of a reinforced concrete beam based on its dimensions, concrete and reinforcement grades, design bending moment, concrete working-condition factor and concrete cover. 15. Structural features of frame elements in multi-storey buildings constructed in seismic regions. 16. Assessment of the technical condition and load-bearing capacity of historic architectural monuments. Determination of their stress-strain state. 17. Crack resistance of reinforced concrete structures. Analysis of normal and inclined cracks in flexural members. 18. Crack width in reinforced concrete members. General principles and calculation of the width of normal and inclined cracks. 19. Deformation of reinforced concrete flexural members. Deformation analysis and curvature of members in uncracked regions. 20. Deformation of reinforced concrete flexural members in cracked regions. Curvature in cracked regions and determination of member deflection. 21. Flat reinforced concrete floor slabs. Precast beam-and-slab floors. Layout and structural schemes of precast floors. Analysis and design of precast reinforced concrete panels. 22. Monolithic ribbed floor slabs. Structural schemes of floor systems. Design and analysis of slabs, main beams and secondary beams. Structural detailing of slabs and beams. 23. Monolithic ribbed floor slabs supported along their perimeter. Structural

	schemes and specific analysis features. Determination of internal forces in perimeter-supported slabs. Design schemes, calculation models and reinforcement of perimeter-supported slabs. 24. Fundamentals of foundation and subsoil design and analysis. Analysis of subsoil bearing capacity. Types of foundations. 25. Shallow foundations on natural ground. Design principles. Determination of the base dimensions of rigid foundations under concentric loading. Fundamentals of analysing eccentrically loaded and flexure-loaded foundations. 26. Foundations constructed under special conditions. Specific design features of foundations on settlement-prone soils and in seismic areas. 27. Fundamentals of foundation design, analysis and reinforcement. General information on foundations. Column footings. 28. Analysis of isolated foundations. Design model of an isolated footing. Column footings and pile-supported column foundations. Reinforcement of column pedestals and foundations. 29. Raft and continuous foundations. Strip and raft foundations. Strip foundations beneath walls. Eccentrically loaded foundations and their calculation model. 30. History of the development of masonry structures. Physical and mechanical properties of materials used in masonry structures.
Student assessment	Student assessment is based on the level of mastery of the teaching materials during the semester and final assessment, as demonstrated through tests, assignments, and written and oral work. Throughout the course “Assessment of the Technical Condition of Buildings and Structures”, students are assessed on a 100-point scale. Of the total, 50 points are allocated to continuous and midterm assessment (60% of these 50 points for continuous assessment and independent study, and 40% for midterm assessment), while 50 points are allocated to the final assessment. Students who score fewer than 30 points in the combined continuous and midterm assessments are not admitted to the final examination. A student who obtains 30 or more points in the final assessment is considered to have passed the course.
Examination requirements	Students must fully master the theoretical and practical concepts covered in the topics and be able to present the results of their analyses correctly. They must complete independent work and assignments given as part of continuous and midterm assessment. Within the established period, students must also obtain the required scores in continuous assessment, midterm assessment, independent study and the final assessment. A student who has not submitted the continuous assessment, midterm assessment or independent study assignments, or who has scored fewer than 30 points for these assignments and assessment components, will not be admitted to the final assessment. A student who misses 25 per cent or more of the contact hours allocated to the course without a valid reason will be removed from the course, will not be admitted to the final examination and will be considered not to have earned the relevant credits for the course. A student who fails the final examination or scores between “0–29.9” in this examination is considered to have an academic debt.
Recommended literature	1. U.U.Djurayev “Temirbeton va tosh konstruksiyalari” Darslik. Jizzax 2022-yil 2. Asqarov B.A, Nizomov Sh.R., Temirbeton va tosh-g‘isht konstruksiyalari. Darslik. Toshkent., Iqtisod-moliya, 2008-yil 3. Yusupxodjayev S.A. “Qurilish konstruksiyalari” Darslik Toshkent. “O‘zbekiston faylasuflari milliy jamiyati” 2019-yil 4. Ablayeva O‘.Sh. “Qurilish konstruksiyalari” Jizzax. Darslik. 2021-yil. 5. V.F.Usmonov “Temirbeton konstruksiyalaridan misollar to‘plami” Samarqand. O‘quv qo‘llanma. 2009-yil. 6. SHNQ 2.01.07-21. Yuklamalar va ta'sirlar. Toshkent., 2021 7. QMQ 2.03.01-24. Beton va temirbeton konstruksiyalari. Toshkent, 2024 8. www.mc.uz 9. www.ZiyoNet.uz 10. www.twirpx.com