Subject name	Construction materials and products (ECTS 8)
Subject/module code	QMB1308
Semesters in which the subject is taught	Semester 3,4
Assigned teacher	Ametov Rasul Nazirbaevich, (PhD) assistant
Language of instruction	Uzbek
Type of subject	Mandatory
Instructional hours (including independent study)	**Total hours – 240.** Classroom session hour - 96. Lecture session hour – 48. Practical training hour – Laboratory session hour – 48. Independent study hour -144.
ECTS	8
Purpose and objectives of the subject / learning outcomes	**The objective of the course:** "Construction Materials and Products" is to provide students in construction-related fields at higher education institutions with an understanding of the selection of raw materials, the production of construction materials, and their application. The course covers several key areas: improving raw materials and products used in construction to meet modern energy-efficiency standards; justifying their suitability for various purposes; reducing the mass of materials while maintaining their technical properties; and developing the skills and experience necessary to implement energy- and resource-efficient technologies in the manufacturing process. **Objectives of the discipline:** to study, analyze, and evaluate construction materials and products; to develop emerging areas both thematic and comprehensive based on supply and demand; to examine modern, energy-efficient, and resource-saving theoretical concepts, as well as the processes involved in the production and application of these materials; and to ensure that students acquire the skills to apply this knowledge within their professional practice. **Learning outcomes.** ***Professional competence:*** Must possess an understanding and knowledge of the development, history, and future prospects of construction materials and products; Must be knowledgeable about the types and applications of raw materials required for the production of construction materials and products, as well as the relevant regulatory documents; Must know how to work with laboratory equipment. ***Skills:*** The nano and micro structure of construction materials and products, as well as their physical-mechanical and chemical properties, are studied; Binding agents used in construction, their raw materials, and their areas of application are examined; Processes for manufacturing construction materials and products based on industrial waste are studied; Application of theoretical and practical knowledge in the field of construction materials and products.
Course content (topics)	**I. Core Theoretical Component (Lecture) – Semester 3** Topic 1: Introduction to the subject of construction materials and products. Aims and objectives of the discipline. Topic 2: Structure of construction materials and products; testing methods for determining their physical and mechanical properties. Topic 3: Production of composite construction materials based on the green economy and their environmental impact. Topic 4: Key properties of natural stone materials; their environmental impact during extraction and processing. Topic 5: Composite wood-based materials and products within the

framework of a green economy.

Topic 6: Ceramic and earthenware materials and products for wall cladding; their production.

Topic 7: Glass and glass products; their fundamental properties.

Topic 8: Efficient, green-energy-based technologies for the production of mineral (inorganic) binders, and construction materials derived from them.

Topic 9: Implementation of innovative, energy-efficient technologies for the production of air-hardening binders.

Topic 10: Hydraulic binders. Cement.

Topic 11: Magnesian binders and organic binders.

Topic 12: Portland cement: its types and applications in construction and manufacturing.

Semester 4

Topic 1: The role and application of industrial waste in the production of construction materials within the context of a green economy.

Topic 2: Types and classification of dry construction mixes and construction mortars.

Topic 3: Concrete: types, properties of lightweight and porous concrete, and processing technologies.

Topic 4: Heavy and ultra-heavy concrete; testing methods.

Topic 5: Reinforced concrete structures and components.

Topic 6: Silicate materials and products: types and classification.

Topic 7: Asbestos and asbestos-based construction materials.

Topic 8: Energy-efficient insulation and acoustic materials for a green economy: types, classification, and selection methods.

Topic 9: Polymer construction materials: types and classification.

Topic 10: Paints, varnishes, and coatings: types and classification. Bituminous materials.

Topic 11: Metals and metal products: types and classification.

Topic 12: Iron and cast-iron products and structures.

II. Guidelines and recommendations for organizing laboratory sessions. Semester 3.

1. Determining the true density and average density of construction materials, and conducting fundamental mechanical tests in a laboratory setting safely and correctly.

2. Determining the volume and average density of construction materials with both regular and irregular geometric shapes.

3. Determining the bulk density and porosity of loose (granular) and powdered construction materials.

4. Determining the water absorption and frost resistance of construction materials.

5. Requirements of the "green economy" regarding the determination of the physical and mechanical properties of timber/wood materials.

6. Determining the quality, flexural and compressive strength, grade, water absorption, and frost resistance of construction bricks.

7. Determining the slaking rate of construction lime, the content of unslaked particles, and the degree of fineness.

8. Determining the fineness, standard consistency, and setting time of construction gypsum.

9. Determining the compressive and flexural strength, as well as the grade, of construction gypsum.

10. Determining the fineness, bulk density, and water demand of Portland cement.

11. Determining the setting time and expansion (soundness/volume stability) of Portland cement paste. 12. Determination of the flexural and compressive strength of Portland cement and its grade.

	Semester 4 1. Determination of the true density, bulk density, and fineness modulus of fine aggregates. 2. Determination of the dust and clay content, water absorption, and moisture content of fine and coarse aggregates. 3. Determination of the true density, average density, and bulk density of coarse aggregates. 4. Determination of the particle size distribution (gradation) of coarse aggregates, as well as the content of flaky (flat) and elongated (needle-shaped) particles. 5. Determination of the strength of coarse aggregates. 6. Determination of the workability (slump/flow), temperature, average density, stiffness, and strength development of concrete mixtures. 7. Preparation of cube specimens for concrete grade determination and their subsequent heat treatment (curing). 8. Determination of the compressive strength and strength class (grade) of cube specimens. 9. Determination of the concrete class (grade) in concrete structures using non-destructive testing equipment (such as XNY_1000 or HT225_NB). 10. Non-destructive determination of reinforcement diameter and concrete cover thickness in concrete structures. 11. Determination of the bulk density, fiber stiffness, and thermal conductivity coefficient of energy-efficient wall and finishing construction materials (developed in the context of a green economy). 12. Determination of the tensile strength of steel and composite reinforcement. **III. Instructions and recommendations for the practical session** Practical sessions are not provided for in the subject's model curriculum. **IV. Independent study and independent work.** The competence for independent learning facilitates students' self-development and enhances the effectiveness of their professional activities. Students carry out independent work either in a traditional format or electronically on their mobile devices, under the guidance of an instructor. 1. Fundamental principles of preparing composite building materials (CBM); analysis of key theoretical approaches. 2. Implementation of new energy-saving technologies in stone processing. 3. Study of technologies for producing energy-efficient ceramic products both traditional and modern. 4. Composition, properties, and production technology of porcelain stoneware (gres). 5. Nanostructure of construction materials and products. 6. Micro- and macrostructure of construction materials and products. 7. Study of technologies for producing binders and products from phosphogypsum to support the development of a green economy. 8. Production of heavy, lightweight, and ultra-lightweight concrete aggregates from secondary resources. 9. Mineral binders: compositions, properties, and innovative technologies for preparing high-strength composite gypsum binders. 10. Recycling of concrete to support the development of a green economy. 11. Prospects for the gypsum industry in Uzbekistan. 12. Methods for modifying concrete composition using mineral and polymeric substances.

	13. Prospects for modifying concrete mixes with super- and hyperplasticizers: energy and resource conservation. 14. Innovative technologies for producing cellular concrete (aerated concrete and foamed concrete). 15. Prospects for the cement industry in Uzbekistan. 16. Technology for producing autoclaved materials based on dune sands. 17. Study of new materials derived from bitumen and polymers. 18. Methods for extending the service life of well-cementing (tombop) materials. 19. Study of plastic and polymer products manufactured in Uzbekistan. 20. The gypsum production process. 21. Application of chemical methods to accelerate concrete hardening; prospects for utilizing solar energy and other non-traditional methods. 22. Energy-efficient reinforced concrete structures for the development of a green economy. 23. Methods for improving the properties of paints and varnishes. 24. Study of timber resources in Uzbekistan. 25. Study of thermal insulation and acoustic materials produced in Uzbekistan; technologies for manufacturing energy-efficient wall materials, and research into their physical-mechanical and thermophysical properties. 26. Study of ferrous and non-ferrous metals. 27. Energy- and resource-saving technologies in the production of construction materials and products. 28. Methods and prospects for developing effective roofing, waterproofing, roll-based, and composite materials. 29. Wood for the development of a green economy: energy- and resource-saving, eco-friendly wood products and structures. 30. Thermal insulation and acoustic materials. 31. Types of steel reinforcement. 32. Construction products and structures made from steel, non-ferrous metals, and their alloys, along with effective methods for their corrosion protection. 33. Inorganic binders used in construction. 34. Calculating the composition of standard heavy-weight concrete. 35. Thermal insulation materials based on local raw materials. 36. Basalt-fiber thermal insulation materials; thermal insulation materials based on cotton stalks, rice husks, and other agricultural waste. 37. Modern composite materials. 38. Latexes, organosilicon compounds, and energy-efficient paint formulations; eco-friendly paint compositions. 39. Thermoplastic polymers in Uzbekistan (polyethylene, polypropylene, polystyrene, polyvinyl acetate, etc.). and products manufactured based on thermosetting polymers, such as urea-formaldehyde, polyesters, etc. 40. Improving the properties of bitumen by modifying its composition with polymer resins and polymer waste. 41. Prospects for the preparation and use of lightweight, ultra-lightweight, and composite construction mortars. 42. Drawbacks of wood-based materials and products. 43. Hydrotechnical, thermal insulation, and fire-resistant materials. 44. Advantages of reinforced concrete. 45. Fiber-reinforced concrete, fiber-reinforced plastics, aerated concrete, and their applications.
Student assessment	The assessment of student knowledge is based on their mastery of

	course materials, as demonstrated through tests, assignments, and written or oral work conducted during the semester and final assessments. In the course on “Dry Construction Mixes for Finishing Works” students are evaluated using a 100-point grading system. Of these, 50 points are allocated to ongoing and intermediate assessments (comprising 60% for current assessments and independent study, and 40% for intermediate assessments), while the remaining 50 points are assigned to the final assessment. Students who score a combined total of less than 30 points from the ongoing and intermediate assessments are not permitted to take the final examination. A student who achieves 30 or more points in the final assessment is considered to have successfully mastered the subject.
Requirements for examinations	The student must have fully mastered the theoretical and practical concepts related to the subject and be able to accurately present the results of their analysis. The student is required to have completed all assignments given as part of independent study, as well as those for ongoing and interim assessments. Furthermore, the student must have earned the necessary points from ongoing, interim, independent study, and final assessments within the designated timeframe. A student who has failed to submit assignments for ongoing or interim assessments and independent study or who has accumulated fewer than 30 points across these components will not be permitted to take the final assessment. Additionally, any student who misses 25% or more of the scheduled in-class hours for a subject without a valid excuse will be removed from the course, barred from the final examination, and considered to have failed to earn the credits associated with that subject. A student who fails the final examination, or who scores between 0 and 29.9 points on such an examination, is considered to have an “academic debt” (i.e., an outstanding academic requirement).
Recommended literature	**Core literature:** 1. A.G’aniyev., A.Rasulov “Qurilish materiallari va buyumlari” Darslik. “TIQXMMI” Milliy tadqiqot universiteti nashriyot-matbaa birlashmasi, Jizzax 2025 yil. 348 b. 2. V.S.Rudnov, E.V.Vladimirova, I.K.Domanskaya, E.S.Gerasimova. Tarjimonlar O.B.Berdiyev., B.S.Azimov., “Qurilish materiallari va buyumlari” O‘quv qo‘llanma. Ekaterinburg. 2018-yil. Ural universiteti bosmaxonasi. 131 b. 3. N.B.Rasulova., Z.H.Qurbonov.”Qurilish materiallarining xom ashyoviy bazasi” O‘quv qo‘llanma.“Fan ziyosi” Toshkent-2022y. 180 b. **Additional literature** 4. Z.H.Qurbonov.“Arxitektura ashyoshunosligi” O‘quv qo‘llanma. “JizPI tipografiyasi” nashriyoti. 2023-y. 221-b. 5. S.R.Majidov., A.A.Xoliyorov. “Qurilish materiallari va buyumlari fanidan lobaratoriya ishlari” O‘quv qo‘llanma. Toshkent-2022 y. 176 b. 6. William D. Callister, JR, David G. Rethwisch. “Materials Science and Engineering” an introduction tenth edition study guide. Printed in the United States of America 2018-y. 975 pages. 7. X.Kuldashev “Beton va Temirbeton texnologiyasi” O‘quv qo‘llanma. “Fan bulog‘i” nashriyoti Samarqand-2021 yil. 134 b. **Internet (Information) Sources** 8. https://uzsmart.uz/kitoblar/files/Elektron%20kutubxona 9.http://library.ziyonet.uz/ru/book/108344 10.https://ftp.idu.ac.id/wpcontent/uploads/ebook/tdg/TEKNOLOGI%20REKAYASA%20MATERIAL%20PERTAHANAN/Materials%20Science%20and%20Engineering%20An%20Introduction%20by%20William%20D.%20Callister,%20Jr.,%20David%20G.%20Rethwish%20(z-

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