

Identification	Department	Engineering and Applied Sciences	
	Program	Bachelor	
	Subject	Concrete Technology	
	Term	Fall, 2026	
	Instructor	Sabira Shahmarova	
	E-mail	sabirashahmarova@gmail.com	
	Phone:		
Prerequisites	Concrete Technology, Ingredients of Concrete, Mix Design of Concrete		
Language	English		
Compulsory/Elective	Compulsory		
Text books and course materials	Slides and the lectures will be shared by group e-mail on the instructor’s dropbox. As the text books, reference can be made to the followings: 1. A EN 206-1:2026, <i>Concrete – Specification, Performance, Production and Conformity</i>. 2. EN 1992-1-1:2023, <i>Eurocode 2 – Design of Concrete Structures</i>. 3. Surahyo, A. (2019). <i>Concrete Construction: Practical Problems and Solutions</i>. Springer. 4. Mehta, P.K., & Monteiro, P.J.M. (2019). <i>Concrete: Microstructure, Properties, and Materials</i>. 5. Tang, W.C., Ryan, P.C., Cui, H.Z., & Liao, W. (2016). <i>Properties of Self-Compacting Concrete with Recycled Coarse Aggregate</i>. <i>Advances in Materials Science and Engineering</i>. 6. Duan, Z., Zhao, W., Ye, T., Zhang, Y., & Zhang, C. (2022). <i>Measurement of Water Absorption of Recycled Aggregate</i>. <i>Materials</i>, 15, 5141. 7. Kothari, A., Habermehl-Cwirzen, K., Hedlund, H., & Cwirzen, A. (2020). <i>A Review of the Mechanical Properties and Durability of Ecological Concretes in a Cold Climate</i>. <i>Materials</i>, 13, 3467. 8. Zhang, C., Li, J., Yu, M., Lu, Y., & Liu, S. (2024). <i>Mechanism and Performance Control Methods of Sulfate Attack on Concrete: A Review</i>. <i>Materials</i>, 17, 4836. 9. Beytekin, H.E., Biricik Altun, Ö., Mardani, A., et al. (2024). <i>Innovative Lightweight Concrete: Effect of Fiber, Bacteria and Nanomaterials</i>. <i>Iranian Polymer Journal</i>, 33, 1327–1350. 10. Lu, L. (2024). <i>Optimal Replacement Ratio of Recycled Concrete Aggregate Balancing Mechanical Performance with Sustainability: A Review</i>. <i>Buildings</i>, 14, 2204. 11. Kravanja, G., Mumtaz, A.R., & Kravanja, S. (2024). <i>A Comprehensive Review of the Advances, Manufacturing, Properties, Innovations, Environmental Impact and Applications of Ultra-High-Performance Concrete (UHPC)</i>. <i>Buildings</i>, 14, 382. 12. Adhikary, S.K., Rathod, N., Adhikary, S.D., et al. (2024). <i>Chemical-Based Self-Healing Concrete: A Review</i>. <i>Discover Civil Engineering</i>, 1, 119. 13. Zhuang, Z., Xu, F., Ye, J., Hu, N., Jiang, L., et al. (2024). <i>A Comprehensive Review of Sustainable Materials and Toolpath Optimization in 3D Concrete Printing</i>. <i>npj Materials Sustainability</i>, 2, 12. 14. Barbhuiya, S., Das, B.B., Adak, D., Kapoor, K., & Tabish, M. (2025). <i>Low Carbon Concrete: Advancements, Challenges and Future Directions in Sustainable Construction</i>. <i>Discover Concrete and Cement</i>, 1, 3.		
Teaching methods	Case analysis		x
	Group discussion		x
	Lab		
	Lecture		x
	Course paper		x
	Others		
Evaluation Criteria	Methods	Date/deadlines	Percentage (%)
	Midterm Exam		30
	Case studies		
	Class Participation		5
	Activity		5
	Quizzes		
	Project		
	Presentation		20
	Laboratory Work (Assignments)		

	Final Exam		40
	Other		
	Total		100%
Course objectives	The success of any concrete structure depends on the designer's knowledge of concrete and its behavior underload, temperature and humidity changes, and exposure to relevant environmental and industrial conditions. This course provides students with a systematic understanding of concrete technology from first principles, including concrete constituents, fresh and hardened concrete properties, mix design, durability, testing, quality control, and advanced and sustainable concrete technologies.		
Learning outcomes	Explain concrete as a structural material and relate its properties to structural performance. Characterize normal aggregates and interpret sieve analysis and water absorption results. Assess water quality and its influence on concrete performance. Explain the behavior of fresh concrete and the role of chemical and mineral admixtures. Select appropriate methods for mixing, handling, placing, compacting, and temperature control. Explain strength development, deformation, cracking, permeability, and durability of concrete. Apply principles of concrete mix design and performance-based mix design. Evaluate sulfate attack, alkali–aggregate reaction, reinforcement corrosion, and freeze–thaw damage. Select appropriate destructive and non-destructive testing methods for concrete. Describe lightweight, recycled aggregate, self-compacting, high-performance, ultra-high-performance, fibre-reinforced, and sprayed concrete. Discuss sustainable and low-carbon concrete and emerging technologies such as self-healing, smart concrete, and 3D concrete printing.		
Course outline	The course combines theoretical and practical aspects of concrete technology in construction. Homework and case-based assignments will be assigned periodically and completed within the specified submission period.		
Policy	Preparation for class The structure of this course makes individual study and preparation outside class extremely important. Lecture materials focus on the major concepts introduced in the assigned readings. Students are expected to review the relevant material before class and to study lecture notes and assigned problems and cases after class. 1. Withdrawal (pass/fail) This course follows the grading policy of the School of Engineering and Applied Science. A student is normally expected to achieve at least 60% to pass. In case of failure, the student will be required to repeat the course in the following term or year. 2. Cheating/plagiarism Cheating or plagiarism during quizzes, the midterm examination, or the final examination will lead to cancellation of the assessment and a grade of zero (0), in accordance with institutional policy. 3. Professional behavior guidelines Students shall behave in a manner that creates a favorable academic and professional environment during class hours. Unauthorized discussions and		

		unethical behavior are prohibited.	
		4. Ethics Students should arrive on time. Mobile phones must be turned off and stowed away before entering the classroom. Electronic devices may be used only when authorized by the instructor for course-related activities. Lessons are conducted in English that’s why questions and their answers must be in English.	
		5. AI Policy GAI tools may only be used as a supplementary aid for conceptual understanding, standard code reference queries, and organizing report structures. Students are strictly required to perform all mix design calculations, material property analyses, and lab report interpretations independently. Any permitted AI assistance must be fully disclosed upon submission, and unauthorized usage will lead to an immediate score reduction or a grade of zero (0).	
Tentative Schedule			
Week	Date	Topics	Textbook/Assignments
1	19.09.2026	Introduction to Concrete Concrete as a Structural Material	EN 206-1:2026 , <i>Concrete – Specification, Performance, Production and Conformity</i> EN 1992-1-1:2023 , <i>Eurocode 2 – Design of Concrete Structures</i>
2	26.09.2026	Normal Aggregates Sieve Analysis of Normal Aggregates	Piccinali, A., Diotti, A., Plizzari, G., & Sorlini, S. (2022) . <i>Impact of Recycled Aggregate on the Mechanical and Environmental Properties of Concrete: A Review</i> . Materials , 15 , 1818 Zhang et al. (2024) . <i>Application of Aggregates from Construction and Demolition Wastes in Concrete: Review</i> . Sustainability , 16 , 4277
3	03.10.2026	Water Absorption of Normal Aggregates Quality of Water for Concrete	EN 1097-6:2022 , <i>Tests for Mechanical and Physical Properties of Aggregates – Determination of Particle Density and Water Absorption</i> ; supplementary reading: Duan, Z. et al. (2022) . <i>Measurement of Water Absorption of Recycled Aggregate</i> . Materials , 15 , 5141 Jain, S. et al. (2024) . <i>A Comprehensive Review on the Use of Wastewater in the Manufacturing of Concrete: Fostering Sustainability through Recycling</i> . Recycling , 9 , 45
4	10.10.2026	Fresh Concrete Admixtures	Roussel, N. et al. (2018) . <i>Rheological Behavior of Fresh Cement Pastes</i> . Fluids , 3 , 106 Raghav, M., Park, T., Yang, H.-M., et al. (2021) . <i>Review of the Effects of Supplementary Cementitious Materials and Chemical Additives on the Physical, Mechanical and Durability Properties of Hydraulic Concrete</i> . Materials , 14 , 7270
5	17.10.2026	Mixing, Handling, Placing and Compacting Concrete Temperature Problems in Concrete	Surahyo, A. (2019) . <i>Concrete Construction: Practical Problems and Solutions</i> . Springer Kaleta-Jurowska, A. & Jurowski, K. (2020) . <i>The Influence of Ambient Temperature on High Performance Concrete Properties</i> . Materials , 13 , 4646
6	24.10.2026	Strength of Concrete Development of Strength	EN 12390-3:2019 , <i>Testing Hardened Concrete – Compressive Strength of Test Specimens</i> Li et al. (2022) . <i>A Review of the Effects of Raw Material Compositions and Steam Curing Regimes on</i>

			<i>the Performance and Microstructure of Precast Concrete. Materials, 15, 2859</i>
7	31.10.2026	Mix Design of Concrete Performance-Based Mix Design	Mehta, P.K. & Monteiro, P.J.M. (2019). <i>Concrete: Microstructure, Properties, and Materials</i> Barbhuiya, S., Das, B.B., Adak, D., Kapoor, K., & Tabish, M. (2025). <i>Low Carbon Concrete: Advancements, Challenges and Future Directions in Sustainable Construction. Discover Concrete and Cement, 1, 3</i>
8	07.11.2026	Midterm Exam	
9	14.11.2026	Deformation and Cracking Independent of Load Permeability and Durability of Concrete	Rossi, P. et al. (2024). <i>A Review on Chemical and Autogenous Shrinkage of Cementitious Systems. Materials, 17, 283</i> Huang, H. et al. (2022). <i>Factors Influencing the Capillary Water Absorption Characteristics of Concrete and Their Relationship to Pore Structure. Applied Sciences, 12, 2211</i>
10	21.11.2026	Sulphate Attack Alkali–Aggregate Reaction	Zhang, C., Li, J., Yu, M., Lu, Y., & Liu, S. (2024). <i>Mechanism and Performance Control Methods of Sulfate Attack on Concrete: A Review. Materials, 17, 4836</i> (2024). <i>Alkali–Silica Reactions: Literature Review on the Influence of Moisture and Temperature and the Knowledge Gap. Materials, 17, 10</i>
11	28.11.2026	Corrosion of Reinforcement Resistance to Freezing and Thawing	Taffese, W.Z. & Nigusie, E. (2020). <i>Autonomous Corrosion Assessment of Reinforced Concrete Structures: Feasibility Study. Sensors, 20, 6825</i> Kothari, A., Habermehl-Cwirzen, K., Hedlund, H., & Cwirzen, A. (2020). <i>A Review of the Mechanical Properties and Durability of Ecological Concretes in a Cold Climate in Comparison to Standard Ordinary Portland Cement-Based Concrete. Materials, 13, 3467</i>
12	05.12.2026	Testing and Non-Destructive Testing (NDT) Lightweight Concrete	Kot, P., Muradov, M., Gkantou, M., et al. (2021). <i>Recent Advancements in Non-Destructive Testing Techniques for Structural Health Monitoring. Applied Sciences, 11, 2750</i> Beytekin, H.E., Biricik Altun, Ö., Mardani, A., et al. (2024). <i>Innovative Lightweight Concrete: Effect of Fiber, Bacteria and Nanomaterials. Iranian Polymer Journal, 33, 1327–1350</i>
13	12.12.2026	Recycled Aggregate Concrete Self-Compacting Concrete (SCC)	Lu, L. (2024). <i>Optimal Replacement Ratio of Recycled Concrete Aggregate Balancing Mechanical Performance with Sustainability: A Review. Buildings, 14, 2204</i> Tang, W.C., Ryan, P.C., Cui, H.Z., & Liao, W. (2016). <i>Properties of Self-Compacting Concrete with Recycled Coarse Aggregate. Advances in Materials Science and Engineering, 2016, 2761294</i>
14	19.12.2026	High-Performance Concrete (HPC) and Ultra-High-Performance Concrete (UHPC) Fibre-Reinforced Concrete and Shotcrete	Kravanja, G., Mumtaz, A.R., & Kravanja, S. (2024). <i>A Comprehensive Review of the Advances, Manufacturing, Properties, Innovations, Environmental Impact and Applications of Ultra-High-Performance Concrete (UHPC). Buildings, 14, 382</i> Manso-Morato, J., Hurtado-Alonso, N., Revilla-Cuesta, V., Skaf, M., & Ortega-López, V. (2024). <i>Fiber-Reinforced Concrete and Its Life Cycle Assessment: A Systematic Review. Journal of Building Engineering, 94, 110062</i>
15	26.12.2026	Sustainable and Low-Carbon Concrete Advanced Concrete Technologies: Self-Healing Concrete, Smart Concrete, and 3D	Barbhuiya, S., Das, B.B., Adak, D., Kapoor, K., & Tabish, M. (2025). <i>Low Carbon Concrete: Advancements, Challenges and Future Directions in</i>

		Concrete Printing	<i>Sustainable Construction. Discover Concrete and Cement, 1, 3</i> Adhikary, S.K., Rathod, N., Adhikary, S.D., et al. (2024). Chemical-Based Self-Healing Concrete: A Review. Discover Civil Engineering, 1, 119 Zhuang, Z., Xu, F., Ye, J., Hu, N., Jiang, L., et al. (2024). A Comprehensive Review of Sustainable Materials and Toolpath Optimization in 3D Concrete Printing
16		Final Exam	