

CIV-E2020 Concrete Technology

08.01.2024 — 19.02.2024

1. Course information

Status of the Course:

Programme Name: Building Technology
Major studies; Construction and Maintenance

Level of the Course: Aalto Eng., Master degree course

Teacher in charge: Prof: Jouni Punkki
Staff Scientist: Fahim Al-Neshawy
Postdoctoral Researcher: Anna Antonova

Teaching Period: Autumn 2024 (Period III)

Registration for Courses: Registration to course using SISU - <https://sisu.aalto.fi/>

Language of Instruction: English

2. Learning outcomes

Upon successful completion of the course, students will gain:

Knowledge:

Gain knowledge about the properties of cement, concrete and special concretes.

Skills:

Perform the process of selecting suitable ingredients of concrete and determining their relative amounts with the objective of producing a concrete of the required, strength, durability, and workability as economically as possible.

Identify properties of concrete in the fresh and hardened states and the effects of mineral and chemical admixtures in concrete

Theoretically predict the thermal and strength development of concrete structures

General competence:

Clearly understand the relevant concrete technology.

Identify the chemical or physical process of concrete structures durability concerns, and design their service life.

3. Course content

The course covers the following topics:

a) Concrete materials

Proportioning of concrete mixtures.

Cement hydration process and microstructure of the hydrated cement paste.

Chemical admixtures and Supplementary Cementing Materials (SCMs).

Interfacial Transition Zone in Concrete (ITZ).

- b) Properties of fresh and hardened concrete
- Workability of concrete.
 - Cohesion of concrete (Segregation and bleeding).
 - Strength of concrete.
 - Durability of concrete.
- c) Durability and service life of concrete structures
- Service life design of concrete structures.
 - Sustainability of concrete.

4. Teaching and learning methods

The course includes the following learning methods and activities:

- Lectures
- Weekly exercises
- Laboratory work – group work and presentations of the laboratory work
- Written exam at the end of the course

4.1 Lectures schedule (subject to change)

The lectures schedule is tentative and may change during the term. The course includes 10 lectures covering the contents of the course as shown in the table below. Lecture notes and presentation slides will be added on myCourses as the course proceeds.

	Day	Date	Time	Topic
1	Mon	08.01.2024	12:15 – 14:00	Concrete materials and mixtures (Mix design)
2	Tue	9.01.2024	12:15 – 14:00	Cement hydration
3	Mon	15.01.2024	12:15 – 14:00	Microstructure of concrete
4	Tue	16.01.2024	12:15 – 14:00	Mineral admixtures (Supplementary Cementing Materials)
5	Mon	22.01.2024	12:15 – 14:00	Chemical admixtures for concrete
6	Tue	23.01.2024	12:15 – 14:00	Properties of fresh concrete
7	Mon	29.01.2024	12:15 – 14:00	Properties of hardened concrete
8	Tue	30.01.2024	12:15 – 14:00	Durability - Concrete degradation mechanisms
9	Mon	05.02.2024	12:15 – 14:00	Durability - Service life design of concrete structures
10	Tue	06.02.2024	12:15 – 14:00	Sustainability of concrete
	Mon	12.02.2024	12:15 – 14:00	Groupwork presentations (lab. based)
	Tue	13.02.2024	12:15 – 14:00	Groupwork presentations (lab. based)
	Thu	15.02.2024	12:15 – 14:00	Groupwork presentations (lab. based)
	Mon	19.02.2024	Exam	Final Exam (13:00 - 16:00 at R1)

4.2 Weekly exercises

The course has 4 weekly exercises. Students submit their solution (individually) into MyCourses system for evaluation within the deadline of each exercise. The weighted value of the weekly exercises is 20% of the course grade.

	Day	Session date	Time	Topic
1	Thu	11.01.2024	12:15 – 14:00	Concrete Mix-Design methods
2	Thu	18.01.2024	12:15 – 14:00	Cement chemistry and microstructure of concrete
3	Thu	25.01.2024	12:15 – 14:00	Chemical admixtures and mineral additives
4	Thu	01.02.2024	12:15 – 14:00	Heat and strength development

4.3 Laboratory work

The main objective of the laboratory work is to design and optimize a concrete mix and predict the heat of hydration and strength development for a given concrete structure. The hands-on laboratory work includes mix design, casting, testing of the fresh and hardened concrete and reporting the results. The laboratory work is weighted as 20% of the final grade. Separate information about the schedule and the content of the laboratory work will be uploaded to myCourses.

4.4 Final exam

The written exam includes 5 questions covering the course outcomes. The questions include (short) essay questions and computational questions (based on the weekly assignments). The final exam is evaluated (grade: 0...5) and its weighted value is 60% of the course grade.

5. Course Workload

The course ETCS and the estimated workload are presented in the following table.

Student activities	Quantity	Duration (Hour)	Total workload (Hour)	% of the total work
Weekly assignments				
Attending the exercise sessions	4	1,75	7	20 %
Weekly exercises	4	5	20	
Group work				
Laboratory work (Mix design, aggregate grading, casting, and testing of concrete)	4	4	16	20 %
Seminar presentation (preparing and presenting)	1	11	11	
Preparing for the exam				
Lectures	10	2	20	
Independent reading for the exam (articles, book chapters, lecture notes etc.)	1	58	58	60 %
Final examination	1	3	3	
Total workload (Hours)			135	
ECTS Credit of the course (workload / 27)			5	

6. Assessment methods and grading scale - evaluation criteria and methods

The grading scale for the course is: 5 (highest); 4; 3; 2; 1 (lowest passing grade); 0 (failed). The course outcome assessment include:

- a) Individual work:
 - Weekly exercises and laboratory report. [40 points, weighted value 40% of the grade]
- b) Written exam:
 - Written exam [60 points, weighted value 60% of the grade].

To pass the course, students should collect at least 50 points from the (written exam + individual work) or (50 points) from only the written exam.

Activity	Total points	Grading	
Final grade	100	0	< 50
		1	50 ... < 60
		2	60 ... < 70
		3	70 ... < 80
		4	80 ... < 90
		5	90 ... 100

7. Study Materials

Recommended readings (selected chapters based on the course contents) from the following books:

- [in English] P. Kumar Mehta, Paulo J. M. Monteiro. Concrete: microstructure, properties, and materials (2006 and 2014). Available at: <https://primo.aalto.fi/>
- [in Finnish] BY 201 Betonitekniikan oppikirja 2018. Julkaisijat: Suomen Betoniyhdistys r.y. Kustantaja: BY-koulutus Oy. Available at: <https://primo.aalto.fi/>
- Course lecture notes and handout – include slides from lectures, explanatory notes, and exercises.

8. Prerequisites

- CIV-E1010 Building Materials Technology 5 op

9. Further Information

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