



CIV-E2030 Experimental Methods in Building Materials L (5 cr)

Course Syllabus

15.04.2019 – 27.05.2019

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1. Course information

Status of the Course: Programme Name: Building Technology

Major studies; Construction and Maintenance

Level of the Course: Aalto Eng, Master and postgraduate degree course

Teachers in charge: Prof. Jussi Leveinen

Prof. Jouni Punkki

Staff Scientist, Fahim Al-Neshawy, D.Sc

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Teaching Period: Spring 2019 (Period V)

Course Homepage: <https://mycourses.aalto.fi/course/view.php?id=20508>

Registration for Courses: Registration to course using WebOodi - <https://oodi.aalto.fi>

Language of Instruction: English

2. Learning Outcomes

The goal of the course is to familiarize students with advanced experimental and characterization techniques commonly used in construction engineering. The students will learn and practice these techniques through (i) lectures, (ii) excursions, laboratory demonstrations, and (iii) group work assignments.

Upon successful completion of the course, students will be able to:

- 1) Distinguish the basic conceptual, theoretical and analytical tools necessary for inspection and evaluation of the civil engineering structures.
- 2) Explore theoretical and practical information for the common non-destructive and destructive testing methods and techniques for civil engineering structures.
- 3) Gain experience with and understanding of the advantages and applications of common experimental field and laboratory testing methods.
- 4) Be able to plan a suitable experimental testing program for a given civil engineering structure for example a thick-walled concrete structure.

3. Course Content

The course covers the following topics:

- 1) Theoretical background
 - Physical nature of the material property or discontinuity to be inspected
 - Physical processes that govern the testing method
 - Physical nature of the interaction of the test probing field with the test material
- 2) In-situ investigation methods
 - Visual inspection of civil engineering structures

- Non-destructive testing of civil engineering structures
 - Destructive testing techniques
 - Evaluation of the condition of civil engineering structures
- 3) Laboratory investigation methods
- Microstructure analysis of building materials – Petrographic analysis, microscopy analyses and computed tomography

4. Teaching methods

The course includes the following teaching methods and activities:

- 1) Lectures
- 2) Laboratory demonstration(s) and excursions
- 3) Writing academic reflection papers
- 4) Group assignment
- 5) Final written exam

4.1 Lectures

Lectures cover the content of the course. The lectures are divided into four topic areas: (i) theory background, (ii) fundamentals of destructive and non-destructive testing techniques and (iii) microstructural testing, analysis and evaluation.

The lecture schedule is presented in Table 1. The schedule listed in the table is preliminary and may change during the course

Table 1. Course lectures – schedule

(Monday lecture 10:00 – 12:00 at R001/U1 (U154) and Wednesday lectures 10:00 – 12:00 at R001/U149 KONECRANES)

Date		Topics	Lecturer	Reflection paper
Mon	15.04.2019	Introduction to experimental testing methods	Fahim Al-Neshawy	Article 01
Wed	17.04.2019	Electrochemical testing methods	Fahim Al-Neshawy	
Mon	22.04.2019	Easter (Pääsiäinen) - Holiday		Article 02
Wed	24.04.2019	Electromagnetic testing methods: Ground Penetrating Radar(GPR) Petrographic examination methods (thin section analysis)	Prof. Jussi Leveinen	
Mon	29.04.2019	Destructive measurements on cores (Strength and Porosity)	Prof. Jouni Punkki	Article 03
Wed	01.05.2019	First of May (Vappu) - Holiday		
Mon	06.05.2019	Ultrasonic testing methods	Tuomas Koskinen, VTT	Article 04
Wed	08.05.2019	Laboratory demonstration	Laboratory staff	
Mon	13.05.2019	Application of computed tomography (CT) in civil engineering	Alvaro Guarín Cobo, KTH Sweden	Article 05
Wed	15.05.2019	Scanning electron microscope for the investigation of building materials	Anna Antonova	
Mon	20.05.2019	Course seminar		
Wed	22.05.2019	Excursion - Vahanen Group		

Exam: Monday, 27.05.2019 (09.00-12.00 at R002/R2)

4.2 Laboratory demonstrations and excursions

The purpose of laboratory demonstration is to help the students learn how to use the common devices available in the laboratory (**list of devices to be confirmed**) for evaluation of a thick-walled concrete structure that was built for research purpose.

One excursion is arranged at the end of the course:

- 1) Excursion - I to Vahanen – Thin-Section centre, (Ohuthietutkimus) - Wed 22.5.2019

4.3 Writing academic reflection papers

Writing academic reflection papers include reading of scientific (academic) articles (5 articles) related to the topic of weekly lectures and reflect the learning from the article. The reflection paper is maximum of two pages reflecting the learning outcomes and discussion about the scientific article. Reflection papers (5 papers) are submitted weekly to myCourses. (Total points = 2 points * 5 articles = **10 points**)

4.4 Group work (assignments)

The assignments include a laboratory work or demonstrations of performing simple experimental tests on building materials (mainly concrete) and reporting of the assignment group work. Total points for the assignment report and presentation = **20 points**

4.5 Final exam

The written exam includes 5 questions covering the course outcomes (total points for the exam = $5 * 14$ = **70 points**).

5. Course Workload

Student workload include attending the lectures, excursions, seminars, participating the group work, writing learning (reflecting) diaries and self-study work. The course ETCS/workload is presented in the following table.

Student activities	Quantity	Duration (h)	Total (h)	% grade
Lectures / Excursions				
<ul style="list-style-type: none"> Attending lectures and excursions 	8 Lectures, 2 Excursion	2	20	≈ 70%
Self-study: Independent work				
<ul style="list-style-type: none"> Independent reading Final examination 	1 1	75 3	75 3	
Group assignments				≈ 30%
<ul style="list-style-type: none"> Laboratory work Report writing 	1 1	4 20	4 20	
Reflection reports	5	3	15	
Total workload (Hours)			137	100%

6. Assessment methods and grading scale

The total points of the course are 100 and the grading scale for course is: 5 (highest); 4; 3; 2; 1 (lowest passing grade); 0 (failed). For passing the course, a minimum of (15) points are required for group work and a minimum of (35) points are required for the exam.

Table 3: Course grading

Total points	Grade
<50	0
50 to <60	1
60 to <70	2
70 to <80	3
80 to <90	4
90 to 100	5

7. Study Materials

- Recommended book for the course:
 - Jean-Paul Balayssac and Vincent Garnier, (2017). Non-Destructive Testing and Evaluation of Civil Engineering Structures.
<https://ebookcentral.proquest.com/lib/aalto-ebooks/detail.action?docID=5165459>
 - Chapter 2. Ultrasonic Methods
 - Chapter 3. Electromagnetic Methods

- Chapter 5. Electrochemical Methods
- Chapter 9. Applications In Situ
- Chapter 10. Methodological Guide
- Course handouts: include slides from lectures, explanatory notes, and additional readings.

8. Ethical Rules

- Aalto University Code of Academic Integrity and Handling Violations Thereof:
<https://into.aalto.fi/display/enregulations/Aalto+University+Code+of+Academic+Integrity+and+Handling+Violations+Thereof> (in English)

9. Prerequisites

- CIV-E1010 Building Materials Technology
- CIV-E2020 Concrete Technology
- CIV-E2060 Production technology of concrete structures